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ABSTRACT

This study investigated the hypothesis that there is a relationship between the output efficiency of research and development and the behavioral characteristics of individuals in the user organization. Through a review of the literature, a number of concepts and models that tend to support the hypothesis are discussed. The authors then present a definition of "linkers" and describe the methodology they developed to identify such individuals through use of a Professional Preference Census (PPC) questionnaire. Findings obtained by using the PPC in a census situation are presented, and the results of tests designed to check the instrument's validity are also reported. The appendix contains sample copies of the PPC questionnaire and of a Linker/Stabilizer Validity Census interview form, as well as detailed statistical analyses of the responses to both instruments. An extensive bibliography of relevant publications is also included. (Author/JG)

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ENHANCEMENT OF RESEARCH AND DEVELOPMENT OUTPUT UTILIZATION EFFICIENCIES; LINKER CONCEPT METHODOLOGY IN THE TECHNOLOGY TRANSFER PROCESS

by
J. W. Creighton
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30 June 1972

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NAVAL POSTGRADUATE SCHOOL

Monterey, California

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It was hypothesized that there is a relationship between the output efficiency utilization of research and development and the behavioral characteristics of the individuals in the user organization. Concepts and models are discussed leading to this hypothesis. A linker type of performance is defined and a methodology for identifying such an individual is formed into a measuring instrument. Results from using the instrument in a census situation are presented. The instrument discrimination is subjected to validity tests and the results are reported.

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Preface

The rate of invention has accelerated almost to a point beyond comprehension by the human mind. The social reward from man's inventive genius is related to the efficiency of utilization of research and development output.

The research described by this report develops and expands concepts and methodology that may be useful in the enhancement of research and development output utilization efficiencies particularly as related to the Naval Civil Engineering Corps.

Many have contributed a great deal to this phase of the research project. Particularly the authors would like to extend their appreciation to Capt. P. A. Phelps, USN, Milan Essoglou, Lt. James Roney, USN, and Lt. Peter Hanson, USN.

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June 1972

Abstract

It was hypothesized that there is a relationship between the output efficiency utilization of research and development and the behavioral characteristics of the individuals in the user organization. Concepts and models are discussed leading to this hypothesis. A linker type of performance is defined and a methodology for identifying such an individual is formed into a measuring instrument. Results from using the instrument in a census situation are presented. The instrument discrimination is subjected to validity tests and the results are reported.

Introduction

"Research and development is neither a substitution for production nor a method of procurement; it is rather a search or process of discovery. Money spent on R & D is not directly intended to buy missiles or airplanes; it buys knowledge," [Klein, p. 1-2].

As expenditures for research and development have continued to increase, the existence of what Havelock terms "the knowledge gap" has become readily apparent to both the suppliers or sources of technological information and the potential users of the knowledge. Specifically, the Naval Facilities Engineering Command was cognizant of such a knowledge gap and was concerned with attempting to define a technology transfer mechanism which could effectively alleviate the effects of the knowledge gap.

Concepts

"Federal agencies have tended to interpret their technology transfer mission in terms of documentation and formal information dissemination," [Doctors, p. 12]. Federal agencies embarked upon this interpretation because it was formerly thought that dissemination of technical literature was an efficient mechanism for accomplishing the task of technology transfer. Not until recently has the orientation of technology transfer shifted to the realization that the transfer of technologies is one aspect in the larger process of technological innovation. Technological innovation is broadly defined to include an idea which is perceived by the individual to be a new method, means, or capacity to perform a particular activity. The result of technology transfer may thus be the acceptance by a user of a practice common elsewhere, or it may be a different application of a given technique designed originally for another use [Gruber & Marquis, p. 255-6]

Consequently technology transfer has been re-defined as "a purposive, conscious effort to move technical devices, materials, methods, and/or information from the point of discovery or development to new users," [Gilmore, p. 2]. It is a planned and rational movement of technology [Spencer, p. 27]. It must be distinguished from the more general process of technological diffusion: the historic, unplanned movement of technical or social items from one user to another without any focused effort to actively transfer the particular item. Thus, the original premise upon which a technology transfer program was devised was not incorrect, per se, because the new concept of a technology transfer program has merely been broadened to not only include dissemination of scientific knowledge, but also to include concern for actively expediting the transformation of knowledge into meaningful innovations. The impression that technical data dissemination and technology transfer are one in the same has created the misconception that the end-product of the research and development process--knowledge--is in final form when it is properly documented and disseminated. To record, catalog, and inventory the knowledge is a necessity; but it is not the final step if the knowledge is to be utilized in the sense of being the main or contributing factor leading to a meaningful innovation. McDonough argues that information has a value (at least subjectively) and will be sought only to the extent that its value exceeds the cost of obtaining it [McDonough, Ch. VI]. The scientist or engineer is able to perceptibly value the information only if he is aware of its existence; otherwise, the value is zero and the information will not be sought.

Models

Since there is a perpetual queue of information waiting to be assimilated outside of the receiver's mind, we are confronted with the task of defining

a transfer mechanism which recognizes the limitations of, and the necessity for technical data dissemination. In simplified terms, a program of technology transfer must include a mechanism which effectively links or couples the source of knowledge with the eventual utilization of that knowledge. The process is depicted in figure 1.

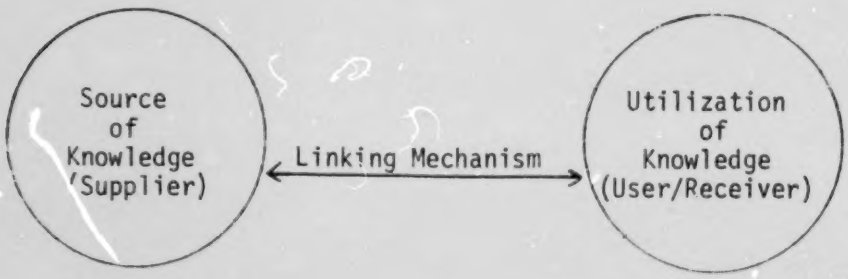

Figure 1. A Simplified View of the Linking Mechanism

The linker mechanism represents the interaction of people. The linker mechanism need not be independent, it may be incorporated in either the supplier or user environment.

The linking mechanism is not merely a series of communication channels through which information flows. It is a complex mechanism which involves the interactions of people. The linking mechanism is not necessarily "additional persons or groups interposed between the two systems," [Havelock, p. 7-1]. It is a people mechanism which can be incorporated into either the supplier or user environment even though the consensus is "that action for really effective technology transfer should start with potential users, rather than sources," [Gilmore, p. 3]. Our placement of the linking mechanism in the user organization was based not only on behavioral considerations, but on economic considerations as well, i.e., the resources necessary to develop a third organization would be better utilized if applied to developing an effective technology transfer mechanism within the user organization. Such a placement was based

upon the hypothesis that given equal resources, an effective transfer mechanism in the user organization will produce a higher coefficient of technology utilization than an intermediary, third organization placed between supplier and user.

The rather vague concept of a linking mechanism is dilineated in the following conceptualization of the process of technology transfer shown as Figure 2. Figure 2 contains several symbols and factor identification codes. These are explained in detail as:

θ_i. This coefficient is a measure of the utilization of the determinant to which it is applied for each organization or individual. Its value may range from 0 to 1.

C_j. This coefficient measures the contribution of each factor to the total transfer process. The sum of all C-factors equals 1.

By multiplying the θ and C coefficients for each organization and factor, a numerical range will be determined to be used in predicting the degree of technology transfer within the user organization.

ORGANIZATION (ORGA). This is the formal organization of the receiver of information and his perception of his position within it.

PROJECT (PROJ). This factor refers to the selection process for research and development projects undertaken by the source, and the receiver's contribution to that process. It has been shown that "a basic reason for the lack of research utilization is that the process is often begun with the research process, rather than the client's needs," [Rogers and Jain, p. 9].

LINKER (LINK). This refers to the number of informal linkers in the receiving organization.

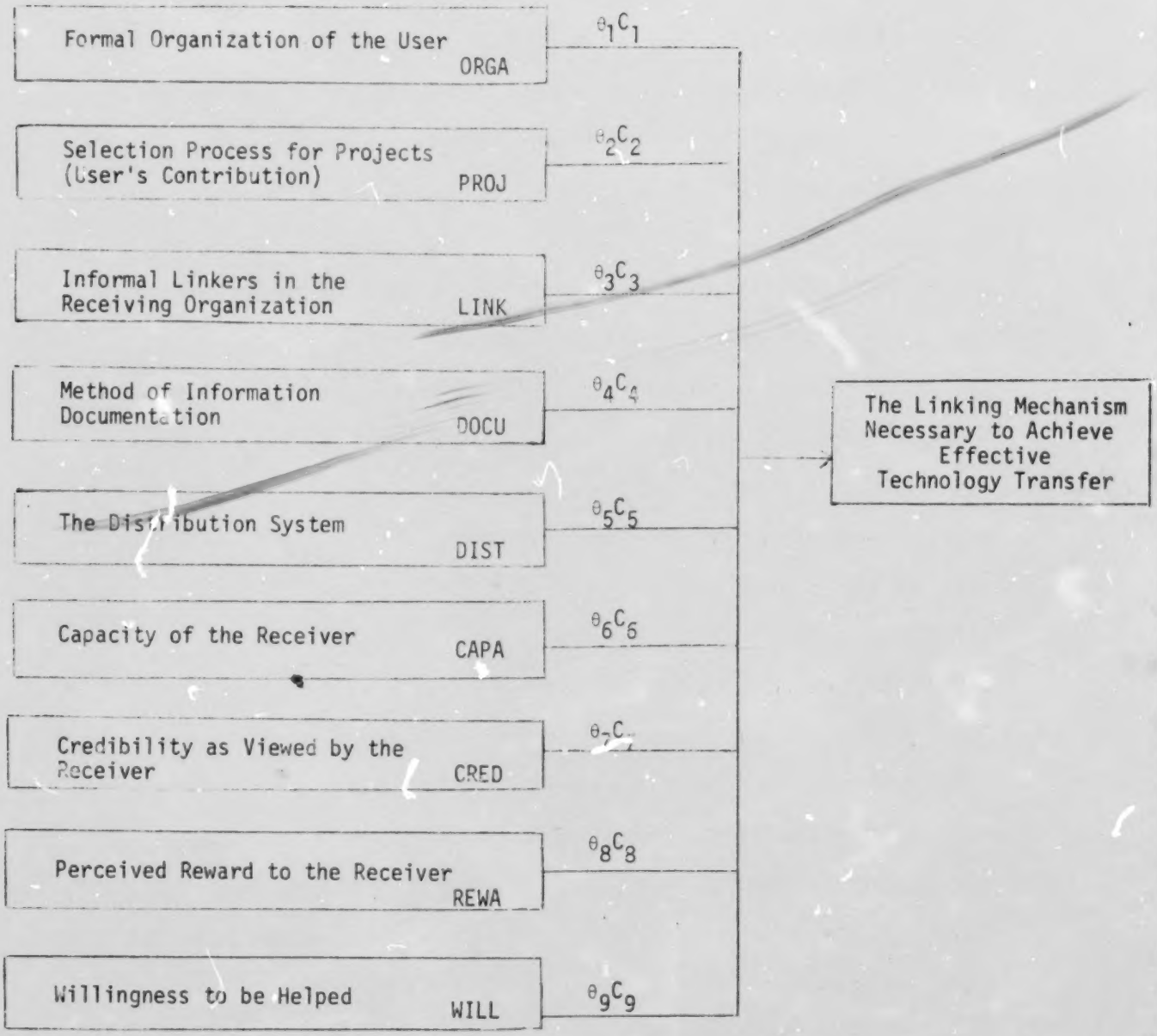

Figure 2. Predictive Model of Technology Transfer.

The model may be expressed in equation form such that:

$$Li = \Sigma\, \theta_i C_j [FACTOR]$$

where

Li = Linker index for an organization

θ_i = a measure of factor utilization, range 0→1

C_j = Factor contribution, $\Sigma C_j = 1$

DOCUMENTATION (DOCU). This is the format, organization, or presentation of the technology being transferred. It is important in that the format and language relate to the understanding of the material by the receiver. One cannot utilize information he cannot interpret.

DISTRIBUTION (DIST). This is the physical channel through which technology flows. Involved are the number of entries and ease of access into the channel as well as the formal distribution plan.

CAPACITY (CAPA). Capacity covers a wide spectrum of traits involving the capacity to assemble and invest resources. These include wealth, power, size, intelligence, education, skill, experience, age, and self-confidence.

CREDIBILITY (CRED). Credibility is an assessment of the reliability of the information as perceived by the receiver. It is assessed by analyzing both the source and channel of the message which the individual receives. Such is done because it is often difficult for the individual to distinguish between the source of the message and the channel which carries that message. Thus the individual attaches a composite credibility to the message derived from both perceived source and channel reliability.

REWARD (REWA). Reward is the perceived and actual recognition of innovative behavior in the social system to which the individual is a member.

WILLINGNESS (WILL). Willingness relates to the individual's ability and/or desire to accept change in the organization of which he is a member.

The predictive model of technology transfer previously postulated can be applied to any individual within an organization concerned with the utilization

of technology. If the individual operates effectively at the interface between knowledge and need, one would define his action to be that of a linker. If the linker is an integral part of the user organization, the predictive model can be depicted in an alternative configuration in order to emphasize the central role which the linker assumes in the transfer mechanism. Since the a coefficient weights each of the variables in the predictive model according to the individual's perception of the contribution each assumes in the transfer process within an organization, the model can be re-structured so that the importance of the linker to each of the other variables can be readily observed. The model indicating the central role of the linker is depicted in Figure 3. The reason for rearranging the predictive model is solely to show that understanding the linker in the user organization and his perception of the relative value of the other variables is the key to unlocking the potential of the linking mechanism as it relates to the process of technology transfer.

Usually the linker is defined as an intermediary between the source of knowledge and the application of knowledge. As such, the Farr's "optimum" flow of knowledge is depicted in Figure 4 [Farr, p. 3].

The gatekeeper shown in Figure 4 is defined as one "who holds the strategic position," [Havelock, p. 7-11], in terms of the flow of knowledge from source to application. The receiving system is so organized that there is a distinct "gate" which must be passed in order to gain increased access to groups of receivers. Sometimes the gatekeeper coincides with the formal leader, but more often he is informally designated by the users to fulfill this informal leadership position within the receiving organization.

Often the gatekeeper coincides with another informal leadership position through which the linker operates--that of the opinion leader. The opinion leader is defined as an individual from whom others seek information and

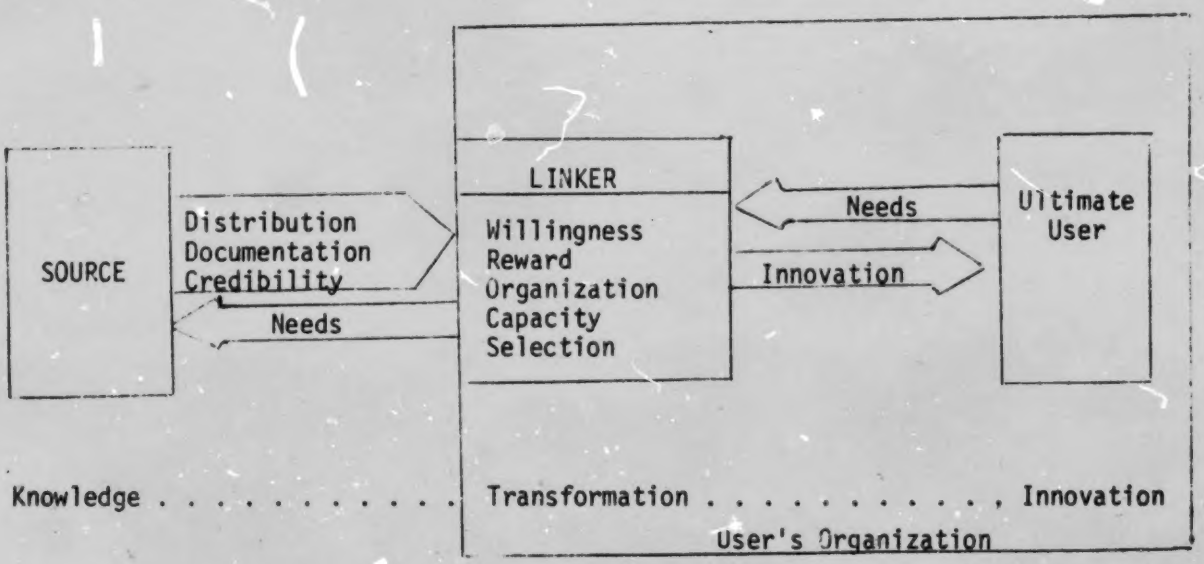

Figure 3. Linker Model of the Technology Transfer Mechanism

This configuration of the linkers position is solely to show the importance of understanding the value of the linker in the technology transfer process.

advice. He is not a dominant leader influencing a passive set of followers; but rather an active or passive informal leader that may seek his followers or may be sought by them. He is "able to informally influence other individuals' attitudes or overt behavior in a desired way with relative frequency," [Rogers and Shoemaker, p. 35].

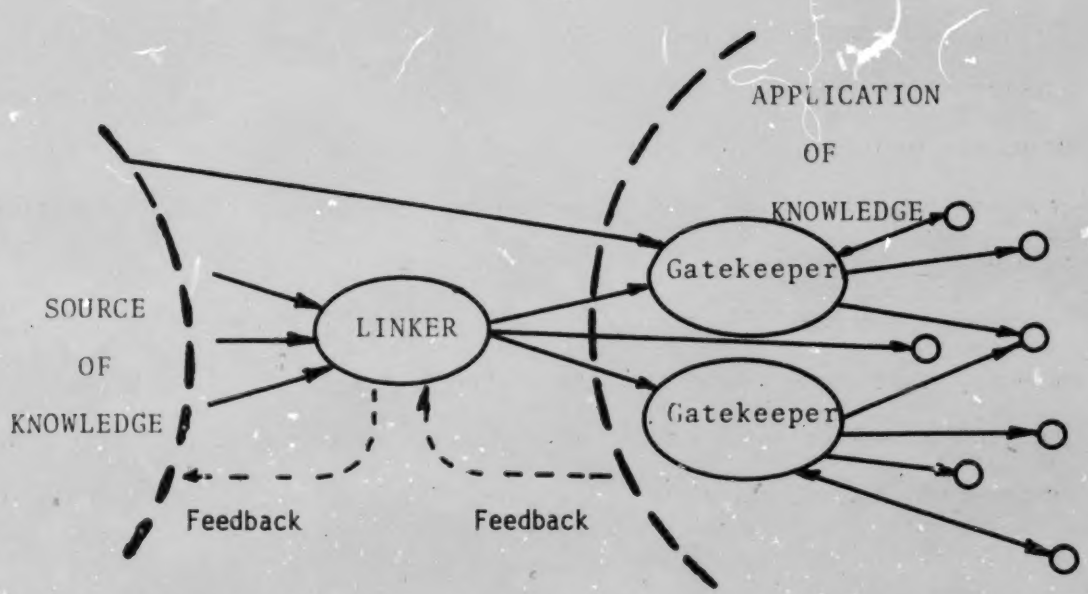

Figure 4. The "optimum" flow of knowledge.

The linker in this Havelock model is isolated from the user by the gatekeeper. In this concept the gatekeeper may be the formal or informal leader of the users. The linker is depicted as a third organiaztion.

Linker Definition

But our usage of the term linker does not assume a third organization or individual acting as an intermediary between the source of knowledge and the utilization of knowledge. Our description of the linker assumes that he operates within the organization which receives the knowledge. Such a restriction upon the role of the linker decreases the usual typology of linking roles to that of the leader (gatekeeper and opinion leader), early adopter of an innovation (innovator), and early knower of an innovation. We do not include the user as a separate role within the above typology because the user's linking role is defined as: "to link by taking initiative on one's own behalf to seek out scientific knowledge and derive useful learnings therefrom," [Havelock, p. 7-4a]. If the user were to assume this role with a relative degree of consistency, he would fall into the role of the early knower or early adopter of an innovation (a new thought, behavior, or thing which is quantitatively different from existing forms) [Barnett, p. 7].

The restriction that the linker operates as a coupling device between the source and use of knowledge within the using organization causes us to reject the general description of the linker role. To describe in "general terms" the linker's role as "simply the gathering, processing, and distribution of educational knowledge," [Farr, p. 3-4] ignores the expanded definition of a linker. It assumes that the linker is solely an intermediary acting at the interface between knowledge and need; a sort of receiver and transmitter of knowledge. Such an assumption does not recognize the fact that the coupling or linking mechanism within the user's organization is only a part of the larger process of technological innovation within that organization.

With the above precepts in mind, the hypothesis was formulated that the

individual functioning as a linker within the user's organization would exhibit similar identifying traits and characteristics as those of the gatekeeper, opinion leader, innovator, and early knower of an innovation. This hypothesis was the basis for the next phase of the research, which was to identify those individuals who are functioning as linkers in the Naval Civil Engineering Corps. It appeared that before relative valuations in the predictive technology transfer model coefficients θ_1, C_j could be determined, the linker needed to be specifically identified. Based on this assumption the identification of the linker was selected as the first step in the process of defining a technology transfer mechanism which would lead to an enhanced understanding of a method of improving research and development output utilization. The remainder of the report discusses the methodology and results of the identification of the individual functioning as a linker in the Naval Civil Engineering Corps.[1]

Identification of the Linker, Methodology

The objective of the second phase of the research was to identify the individual functioning as a linker within the CEC. The problem was one of developing an effective but economic method of identification. Since the identification of the linker was the first in a series of research efforts concerning the linker, the present study eliminated the alternative of surveying some sample of the CEC through random sample selection techniques. The ultimate goal of this phase of the research was to identify a sub population of the corps which exhibits linker characteristics so that further

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[1] One must be careful to note that this phase of the research is not intended to identify those individuals who have the potential to be linkers, but only those individuals who are functioning as linkers at the time of the research.

research can be conducted using this sub population. Hence a sampling technique would not be congruent with the ultimate goal. The method of identification was narrowed to some type of self-administered questionnaire because of the above constraint and the size of the CEC (greater than 1700 officers).

Two types of self-administered questionnaires were initially proposed to accomplish the linker identification within the CEC. The first type was the peer ratings method where members of an organization are asked to designate the linkers within the corps after reading a description of the qualities and characteristics of a linker. The second type was the self-designating method where each respondent is asked a series of questions which indirectly measures the degree to which he perceives himself to be a linker. The first method was rejected for two main reasons: (1) the number of different types of organizations within the CEC would necessitate accepting the hypothesis that linkers function independent of their organizational context (a hypothesis we could not accept because there has not been any definitive evidence to indicate that such is the case[2]); and (2) the number of organizational environments would bias the linker identification toward individual organizations and thus preclude the identification of a homogeneous group of individuals functioning as linkers.

The self-designating method was accepted as a viable means of identification primarily because it was the only method available which did not present serious drawbacks. Naturally, the accuracy with which respondents can identify and report self-perceived images is a limitation which cannot be denied. But the self-designating technique offers a compensatory advantage

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[2] The longitudinal efforts of our research project will attempt to show the relative effect of the organization upon the linker's ability to function.

in that the individual's perceptions are what actually affect his behavior [Rogers and Shoemaker, p. 216]. Hence, the method of identifying the functioning linker was a self-designating type of questionnaire based upon the qualities and characteristics which previous research had correlated with the opinion leader, gatekeeper, innovator, and early knower of an innovation.

Linker Identification Instrument Development

A self-designating questionnaire was initially developed (see Appendix One) based upon an extensive research of literature which examined the characteristics and qualities of the opinion leader, gatekeeper, innovator, and early adopter of an innovation. The questionnaire was entitled the Professional Preference Census (PPC). It contained nineteen multiple-choice questions which, in most cases, offered the respondent a continuum of possible responses; and a single open-ended question dealing with biographical data. Each of the nineteen multiple-choice questions in the PPC will be discussed so as to ascertain the characteristics and/or qualities upon which the question is based. But it must be kept in mind that a single question is not an indicator of whether or not an individual is functioning as a linker. Only the composite total of the responses to all nineteen questions serves as a discriminating device. Thus, the attribute and/or characteristic upon which the question is based cannot be viewed as a discriminating factor unto itself.

One of the primary sources from which information was drawn concerning the characteristics and/or qualities of the opinion leader, gatekeeper, innovator, and early knower of an innovation was the Diffusion Documents Center (DDC) at Michigan State University. In synthesizing the studies at the DDC, Everett M. Rogers and F. Floyd Shoemaker in their book Communication

of Innovations: A Cross-Cultural Approach (1971) have analyzed approximately 1,200 empirical reports and about 300 non-empirical reports from a variety of authors and disciplines. From content analysis of these research publications, Rogers and Shoemaker have developed a series of generalizations concerning the opinion leader, early knower and early adopter of an innovation. The generalizations combined with additional research on the characteristics of a "linker" are the basis for each question in the PPC.

The first question in the PPC was, "Indicate what you expect your income to be 15 years from now." It was partially based upon the following proposition from Rogers and Shoemaker:

(1) Earlier adopters have higher aspirations (for education, occupations, and so on) than later adopters [Rogers and Shoemaker, p. 188].

The generalization is suported by 29 of the 39 studies that have been performed [Rogers and Shoemaker, p. 367-8]. Rogers also found in an earlier study that innovators and early adopters earn a higher gross income [Rogers, 1, p. 72]. In addition, Bell's findings indicated that with respect to consumer durable goods innovators differed significantly income-wise from non-innovators [Bell, p. 90]. The above research findings led us to the conclusion that question one would be a favorable indicator to the composite linker score.

Question two was, "Indicate the type of information upon which you would tend to place the highest credibility." The question was based upon the assumption that a "linker" would be classified as a "better performer" as contrasted with a "poorer performer" in terms of desired output. As such, Massey has found that better performing scientific and technical personnel tend to place most reliance upon information which they have stored in their own minds, and second most on that stored in the minds of others. Formal or written communication was given lowest relative valuation [Massey, p. 57-58].

Additionally, the Conference on the Human Factor in the Transfer of Technology agreed that scientific and technological information experiences its earliest transfer in terms of people-to-people interactions rather than through formal publication [Reiss, p. 109]. Further research has indicated that opinion leaders are primarily affected not by the communication media but by still other people [Katz,1,p. 77]. Also, nearly 60 per cent of the innovators studied by Blackwell reported word-of-mouth communication to be the single most effective source in their decision to adopt an innovation [Blackwell, p. 19]. The assumption was made that the source of information which the "linker" perceived to be the most credible was that source which the above research findings have indicated to be the most effective.

Question three was: "At the present time if you had to place yourself in one of the following social classes, which would you choose?" The following generalizations from Rogers and Shoemaker provide the basis for this question:

(1) Earlier adopters have higher social status than later adopters [Rogers and Shoemaker, p. 186].

(2) Earlier knowers of an innovation have higher social status than later adopters [Rogers and Shoemaker, p. 108].

(3) Opinion leaders have higher social status than their followers [Rogers and Shoemaker, p. 218-19].

The first generalization is based upon 402 individual studies of which 68 per cent are supporting [Rogers and Shoemaker, p. 357-60]. The second proposition is supported by 64 per cent of the 28 studies performed [Rogers and Shoemaker, p. 348]. The final generalization has 20 of the 27 studies performed in support of the general statement [Rogers and Shoemaker, p. 379]. Further research concerning identifying characteristics of the gatekeeper

indicates that he is likely to be in a position of slightly higher status than those he influences [Farr, p. 10]. One of the indicators of social status in the cited studies was self-perceived identification with a social class; therefore, question three asking the respondent to which social class he perceives himself to be a member is consistent with the above studies.

Both the fourth question in the PPC ("Indicate which word, when placed in the following sentence, would most accurately describe you: I feel that I hear about new things _____ most of my colleagues") and the eighteenth question ("Indicate which of the following does not describe a new product or new process") are based upon the following generalization from Rogers and Shoemaker:

(1) Earlier adopters have greater knowledge of innovators than later adopters [Rogers and Shoemaker, p. 189].

Forty-two of the 55 empirical studies performed support the above proposition [Rogers and Shoemaker, p. 374-75]. Naturally, the identification of the group "early knowers of an innovation" inherently supports question four because such a group has been the dependent variable in over 100 empirical studies [Rogers and Shoemaker, p. 347-50] concerned with relating certain attributes and characteristics to this group. Similarly, gatekeepers by definition act in "such a way that the passing or not passing of a unit through the whole channel depends to a high degree upon what happens in the gate region," [Lewin, p. 199]. It follows from the functions of a gatekeeper that he would hear of new things prior to the group/s of receivers for whom he acts as a gate. The above findings and conclusions are the basis for question four and eighteen's inclusion in the PPC.

Question five, "Indicate the number of technical, professional, and/or scientific society meetings which you attended last year," has the same basis

as question twelve, "Indicate what you consider your primary reference group to be," and question sixteen, "How many miles do you travel a year independent of any permanent change of station." The following propositions from Rogers and Shoemaker were a major source from which the questions were derived:

(1) Earlier adopters are more cosmopolite than later adopters [Rogers and Shoemaker, p. 189].

(2) Earlier knowers of an innovation are more cosmopolite than later knowers [Rogers and Shoemaker, p. 108].

(3) Opinion leaders are more cosmopolite than their followers [Rogers and Shoemaker, p. 218].

The first generalization is supported by 76 per cent of the 174 empirical studies performed [Rogers and Shoemaker, p. 369-71]. The second proposition is supported by five of the five studies performed [Rogers and Shoemaker, p. 349-50]; while the final conclusion is based on 13 studies, 77 per cent of which favor the general statement [Rogers and Shoemaker, p. 378]. Cosmopoliteness is defined as "the degree to which an individual's orientation is external to a particular system," [Rogers and Shoemaker, p. 89]. The dichotomy is between local and cosmopolitan individuals. The local largely confines his interests and activities to the organization or community of which he is an integral member. The cosmopolitan is more oriented toward that which is common to all the world or that which is something greater than the limited local environment. Coleman, Katz, and Menzel found that "the physician innovator is more often to be found in attendance at out-of-town meetings of medical groups; visit out-of-town medical institutions and teaching hospitals . . . ; and look to a greater number of out-of-town medical institutions as sources of their medical knowledge [Katz, 2, p. 78].

One of the characteristics Farr cited as distinguishing the gatekeepers from the remainder of the audience was their "cosmopoliteness--their general orientation toward persons and topics external to their own group. They are more likely to attend conventions, be interested in new things, belong to special organizations, and have personal contacts with individuals outside their own group," [Farr, p. 10]. Obviously, the above research identifies numerous characteristics which could serve as the basis for a question. But, given the limiting parameters associated with the self-designating questionnaire and the rather unique audience for this questionnaire, questions five, twelve, and sixteen appeared to be a viable means of utilizing the "cosmopolite nature" of a linker as a discriminating instrument.

Question six asked, "When you are on the job, do you most prefer work that is?" The alternatives ranged from "concerned with accomplishing a specific task" to "concerned with attempting to solve a challenging but not specifically assigned task." The question was based upon the following proposition from Rogers and Shoemaker:

(1) Earlier adopters have higher levels of achievement motivation than later adopters [Rogers and Shoemaker, p. 188].

The generalization is derived from 23 empirical studies of which 61 per cent support the conclusion [Rogers and Shoemaker, p. 367]. Rogers went on to define achievement motivation as a "social value which emphasizes a desire for excellence in order for an individual to attain a sense of personal accomplishment," [Rogers and Shoemaker, p. 188]. Further research by Roberts indicates that "the higher performers, when measured by the Thematic Apperception Test generally show a high need for achievement," [Roberts, p. 235]. These research findings when combined with the intuitive feeling of the researchers that the "linker" would be challenge rather than task-oriented

created the foundation for question six.

The seventh question in the PPC asked the respondent, "In the past month how many times have you sought further information about an idea which you thought to be new and useful to your work?" It was derived from the following conclusion from Rogers and Shoemaker?

(1) Earlier adopters seek information about innovations more than later adopters [Rogers and Shoemaker, p. 389].

The generalization is based on 14 empirical studies; only 2 of which do not support the conclusion [Rogers and Shoemaker, p. 374]. Additional research indicated that the gatekeeper actively seeks out information and then makes it available to the rest of the audience [Farr, p. 10]. Also, since the opinion leader, gatekeeper, innovator, and early knower of an innovation use mass media and other sources of external information more extensively than their counterparts, Thorelli [p. 427-28] has found that consumer groups who have greater exposure to the mass media tend to consult each of several product information sources more extensively for product information in general than those who are not exposed to a considerable amount of mass media. The research findings were consistent with the belief by the researchers that a "linker" would tend to actively seek information to a greater extent than would other individuals within the user organization.

Question eight, "Indicate the frequency with which your colleagues came to you in the past month for work related information and/or advice" and question fifteen, "During the last month, indicate the relative frequency with which you recommend a specific journal and/or magazine article to a colleague which dealt with a work related topic" are based upon Rogers and Shoemaker's conclusion that:

(1) Earlier adopters have a higher degree of opinion leadership than

later adopters [Rogers and Shoemaker, 189].

Sixty-one of the 80 empirical studies relating innovativeness to opinion leadership support the above generalization [Rogers and Shoemaker, p. 375-76]. Inherent in the definition of opinion leadership is the concept that information flows both to and from the opinion leader. Reynolds and Dardin have identified several findings in the literature which tend to support the concept that there is a two-way transfer of information with respect to opinion leaders and non-leaders. They have found that opinion leaders are more active as receivers of product information from personal sources than non-leaders [Reynolds, p. 449]. Bales [p. 2-7] review of opinion leader--non-leader interaction studies revealed that those individuals who transmitted most frequently also received the largest number of communications. Additional research concludes that "there seems to be no question that the first users of a product or service (innovators) are active in the word-of-mouth channel [Blackwell, p. 15]. It further states that when innovators are compared with the population as a whole, they are asked significantly more frequently for their opinion about new things, and are significantly more prone to relate unprompted experiences about innovations to others. The study also produced significant results which indicated that innovators perceive themselves to be more active disseminators of new product information than most people [Blackwell, p. 16-17]. As Rosenbloom and Wolek [p. 102] stated, "The values that lead one man to seek to keep up with his field, or the social bonds that lead another to call his attention to certain information, are as much a part of the information transfer system as are conferences, journals, and documentation system. The above research findings were the basis for the construction of two questions which would discriminate with respect to the relative frequency with which the respondent "transmitted

and received" ideas and/or information.[3]

The ninth question in the PPC asked the respondent to: "Indicate the level within the social strata to which you would aspire to be 10 years from now." It is based upon the concept of social mobility, which according to Lipset and Bendix [p. 1] is "the process by which individuals move from one position to another in society--positions which by general consent have been given specific hierarchial values. Specifically, Rogers and Shoemaker conclude that:

(1) Earlier adopters have a greater degree of upward social mobility than later adopters [Rogers and Shoemaker, p. 186].

The conclusion was derived from five empirical studies of which 100 per cent support the general statement [Rogers and Shoemaker, p. 361]. It was felt that a "linker" operating in an environment of technological innovation would perceive himself to not only be of higher status, but would also perceive himself to be indirectly striving for still higher levels of social status.

The tenth question was, "Indicate the dollar budget for which you have control at your present billet." It was based upon the assumption that the following generalization from Rogers and Shoemaker [p. 186] was applicable to the military environment.

(1) Earlier adopters have larger sized units (farms and so on) than later adopters.

The proposition was based on 222 empirical studies in disciplines ranging from rural sociology to marketing to medical sociology. Sixty-seven per cent of

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[3] One should note that such questions do not assume the existence of a trait of generalized opinion leadership. The questions are a direct result of the phenomenon that innovativeness elicits a certain degree of opinion leadership; but only with respect to the innovation in question [Robertson, p. 54].

the studies support the conclusion [Rogers and Shoemaker, p. 361-3].

Question eleven ("In your experience, which of the following do you tend to rely most heavily upon as a source of technical information?") was based on a number of research findings related to the flow of technical and/or scientific information. The (central theme) of the question was the theory developed by McDonough that a communication receiver assigns values to information channels. The absolute value given any one channel differs from individual to individual, but the extent of use of a channel will depend on its relative valuation by a receiver vis-a-vis other available channels [Rovelstad, p. 40]. Consequently, question eleven is asking the respondent to recall which channel of information he perceives to be most important. Research has indicated that "innovators . . . get their ideas directly from their colleagues" [Riley, p. 544]. A related marketing study of durable goods' innovators by Bell [p. 91] pointed out that informal sources of communication appeared to be most effective in reaching the innovators. Over one-third of the innovators responded that friends were the original source of information regarding the products studied. Less than 15 per cent mention any type of mass media. Project Hindsight, a Defense Department study of the origins of information and ideas which were of primary importance in development of twenty operational weapon systems, showed that in 70 per cent of the cases personal contact was the medium by which the information was introduced into the using system [Rosenbloom and Wolek, p. 14]. Additionally, Allen [p. 137-153] reported that better performing groups rely more than poorer performers upon internal sources of information as contrasted with external sources of information. But he went on to point out that the gatekeeper (a member of the better performing group) is unusually active as a collector and disseminator of technical information, not only from person-to-person contacts within the firm,

but also from literature and personal contacts outside the firm. The above findings led us to the conclusion that the gatekeeper and innovator would tend to value the interpersonal information channels to a greater degree than the non-personal channels, even though their exposure to both is greater than their counterparts. Two generalizations by Rogers and Shoemaker [p. 189] lend credence to the observation that a "linker" would tend to be highly active in the interpersonal channels:

(1) Earlier adopters have greater exposure to interpersonal communication channels than later adopters.

(2) Earlier knowers of an innovation have more exposure to interpersonal channels of communication than late knowers [Rogers and Shoemaker, p. 108].

Forty six of 60 empirical studies support the first conclusion [Rogers and Shoemaker, p. 374]; while 16 of 18 studies support the second general statement [Rogers and Shoemaker, p. 349]. Naturally, exposure does not connote reliance; but exposure to the interpersonal channels merely indicates that "linker types" are highly exposed to the channels upon which the research shows that they tend to place most reliance.

Question thirteen was: "Indicate the total number of journals, magazines and newspapers which you regularly read." A primary reason for its inclusion in the PPC is the following propositions from Rogers and Shoemaker [p. 189]:

(1) Earlier adopters have greater exposure to mass media communication channels than later adopters.

(2) Earlier knowers of an innovation have more exposure to mass media channels of communication than late knowers [Rogers and Shoemaker, p. 108].

(3) Opinion leaders have greater exposure to mass media than their followers [Rogers and Shoemaker, p. 218].

The first generalization is based on 116 empirical studies of which 69 per cent support the statement [Rogers and Shoemaker, p. 372-73]; the second on 29 studies of which 62 per cent support the conclusion [Rogers and Shoemaker, p. 348]; and the final on 10 studies of which 90 per cent are supporting [Rogers and Shoemaker, p. 378]. In addition, research concerning the gate-keepers has shown that "they use mass media and other sources of information external to their own group more frequently"[Farr, p. 10] than do the group/s of receivers for whom they act as a gate. Further research by Lazarsfeld and others [p. 50-51] concluded that "compared with the rest of the population, opinion leaders were found to be considerably more exposed to the radio, to the newspaper, and to magazines, that is to the formal media of communication." More recent research substantiates the findings that opinion leaders tend to be more exposed to mass communications than non-leaders, particularly to topic-relevant media [Thorelli, p. 452]. Similarly, Katz [2,p.78] found that the medical innovator was more likely to subscribe to a larger number of medical journals. Engel, et al. [p. 4], found that the innovator, when compared to the general population, more frequently was a subscriber to five or more magazines. The above research findings offered a wide spectrum of possible questions that could be developed so as to utilize "exposure to mass media" as a discriminating variable--question thirteen appeared to be a viable means with which to do so.

The apparent conflict in the research results presented as substantiation for question eleven and question thirteen is resolved by the fact that the "innovation-decision process" is often viewed as four sequential functions: (1) knowledge--the individual is exposed to the innovation's existence and gains some understanding of how it functions, (2) persuasion--the individual forms a favorable or unfavorable attitude toward the innovation, (3) decision

--the individual engages in activities which lead to a choice to adopt or reject the innovation, and (4) confirmation--the individual seeks reinforcement for the innovation--decision he has made [Rogers and Shoemaker, p. 132]. Considering this descriptionand two generalizations from Rogers and Shoemaker, the seeming discrepancy between the reported research finding for questions eleven and thirteen is resolved.

(1) Mass media channels are relatively more important at the knowledge function, and interpersonal channels are relatively more important at the persuasion function in the innovation-decision process [Rogers and Shoemaker, p. 255].

(2) Cosmopolite communication channels (channels from outside the social system being investigated) are relatively more important at the knowledge function, and localite channels are relatively more important at the persuasion function in the innovation-decision process [Rogers and Shoemaker, p. 258].

Eighteen of 20 studies support the first conclusion [Rogers and Shoemaker, p. 382-3]; while 6 of 7 studies support the second general statement [Rogers and Shoemaker, p. 383]. Similar findings were reported by Engel, et al. [p. 7], indicating that word-of-mouth communication was the most important source of information in the final stage prior to trial, but the mass media played an important role in stimulating awareness and initial interest in the early stages of the innovative process. These research findings clearly established the logic which refuted the apparent inconsistencies in the reported research findings for question eleven and thirteen.

The fourteenth question in the PPC was: "Indicate which of the following best characterizes your approach to an innovative idea." The choices ranged from "venturesome--very eager to try new ideas"--to "prefer to only use

proven ideas." The responses were selected from a continuum of characteristics which began with venturesomeness as a dominant value of the innovator and continued to skepticism as a dominant value of the stabilizer, (the last to adopt an innovation). The continuum was based upon Rogers and Rogers [p. 330] observations of the five adopter categories (a classification of individuals within a social system on the basis of innovativeness). Additional research by Politz [p. 51] lends support to the hypothesis that venturesomeness is a general attribute of the innovator. Politz concluded that: "In the course of studying the reaction of consumers to the products which have been introduced, it was observed that individuals do differ with respect to venturesomeness. There are some individuals who are of the adventurous type. They are the people who are the first to buy new products and try innovations. On the other end of the scale there are people who tend to be extremely cautious. These are the people who will buy a new product only after it has been proven that the new product is worthwhile. Further research by Robertson [p. 220] on the determinants of innovative behavior indicates that venturesomeness makes the greatest contribution of any of the seven predispositional factors which he researched (social mobility, priviledgedness, venturesomeness, cosmopoliteness, interest polymorphism, social integration and personality) toward the overall difference between the average point scores of innovators and non-innovators when a linear discriminate function was used to assign weights to the various predispositional factors. After further analysis, Robertson [p. 220] went on to conclude that "innovators preceive themselves as innovators." The conclusion from the research findings was that a question should be developed which dealt with the respondent's perceived identification as an innovator using venturesomeness as a key identifying characteristic of the innovator. As a result, question fourteen was developed.

Question seventeen was a situational type of question in which the respondent was asked to "Indicate which of the following financial decisions you would advise Mr. E. to make for his home improvements." It was a projective question in that the respondent's attitude and feelings toward assuming debt and entering into a credit relationship would be indicated in his financial advice to Mr. E.. The question was based upon the following generalization from Rogers and Shoemaker [p. 186]:

(1) Earlier adopters have a more favorable attitude toward credit (borrowing) than later adopters.

The statement is based on 25 studies of which 76 per cent support the conclusion [Rogers and Shoemaker, p. 363]. This proposition is the basis for question seventeen.

Question nineteen is the same type of question as number seventeen except that it asked the respondent to "Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A. to take the new job." It is also a projective question which will indirectly indicate the respondents general tendency to assume risk. Rogers' and Shoemaker's [p. 188] generalization provided the basis for the final question in the PPC.

(1) Earlier adopters have a more favorable attitude toward risk than later adopters.

Twenty-seven of the thirty-seven empirical studies performed with risk as the independent variable support the general statement [Rogers and Shoemaker, p. 366]. This proposition is the basis upon which the final question is based.

Validity Instrument Development

Prior to initial administration of the PPC, an oral questionnaire was developed entitled the Oral Linker Census (OLC) [see Appendix Two]. The questions in the PPC were the basis for the OLC. It was designed to be administered to those respondents which the PPC identified as linkers (individuals with an extremely high score on the PPC) and to those it identified as stabilizers (individuals with an extremely low score on the PPC). The purposes of the OLC were twofold: (1) to ascertain whether or not the written questionnaire was discriminating accurately with respect to the hypothesized characteristics of a linker, and (2) to determine the respondent's interpretation of certain phrases, words, and questions in the written questionnaire, e.g., "primary reference group," "source of technical information about an idea . . ." The OLC contained six open-ended questions, each of which were scored from 1 to 10 by the interviewer. The score was based upon the interviewer's subjective evaluation of the degree to which the individual's response to the question indicated that he possessed the characteristics of a linker (score of 10 or 9), potential linker (8,7), member of the non-discriminating majority (6,5), potential stabilizer (4,3), or stabilizer (2,1).

Testing of PPC and OLC

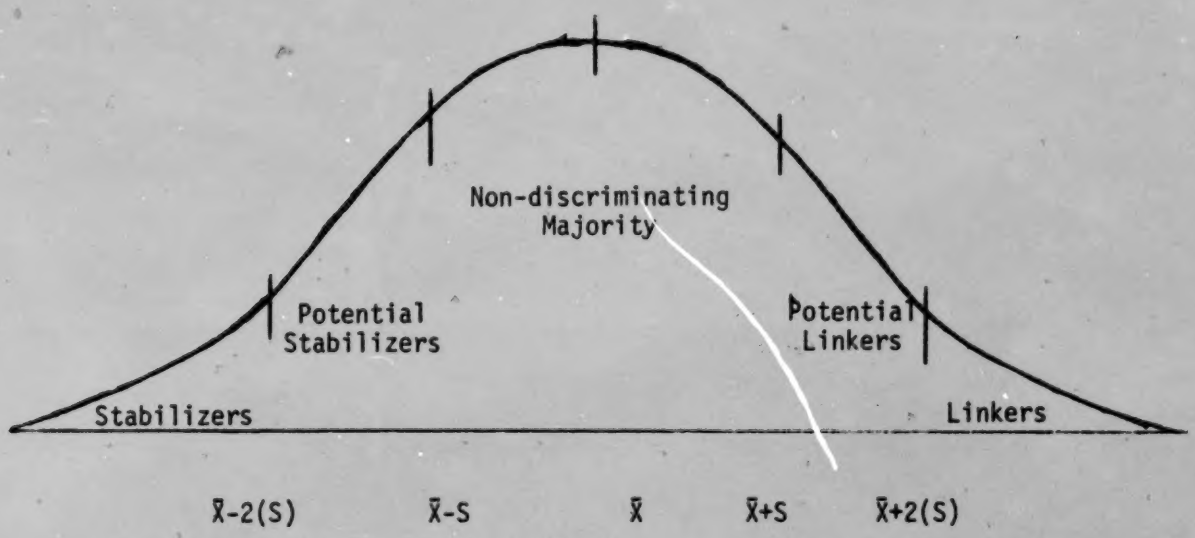
With the Professional Preference Census and its counterpart, the Oral Linker Census developed, the decision was made to initially administer the two questionnaires to the 27 Civil Engineer Corps Officers who lived in the Monterey area and to 73 students in four different sections of a fundamental management class (MN 3105) at the Naval Postgraduate School. The initial administration was solely for the purpose of refining both instruments prior to their use in the entire Civil Engineer Corps.

The vast majority of the trial sample (95 per cent) were attending the Naval Postgraduate School when the PPC was administered to them. As a result, they were specifically asked to complete the census in the context of their last duty station. In addition, they were requested to constructively criticize and evaluate the questions in the PPC in terms of their intent, content, length, etc.. An explanation of the eventual purpose of the PPC was not given in the accompanying cover letter in order to avoid the introduction of unnecessary bias into the results.

As predicted the response rate of the 73 students was 100 per cent, while the corresponding rate for the 27 CEC officers was 67 per cent. Both groups were combined into one sample for the data analysis which identified those individuals who perceived themselves to be functioning as a linker or stabilizer at their last duty station. The data analysis involved assigning to each response for each question a value from one to five. The value assignment was based upon the previously mentioned research for each question in the PPC. A response was given a value of five if it identified a positive linker attribute, while a response assigned the value of one was indicative of a non-linker or stabilizer attribute. The gradation of values between one and five was merely an indication of whether the response tended toward linker or stabilizer characteristics. From the values assigned to the response to each question, a composite score was developed which served as the means of identifying those individuals who were functioning as linkers.

Based upon a method similar to Roger's [2, p. 345-54] classification of adopters, the composite scores of the trial sample were divided into groups on the basis of the standard deviation of the sample scores. The standard deviation, being a measure of dispersion about the mean, offered an initial method by which the sample could be classified. Given the total distribution of

scores from the trial, the respondents indicating linker characteristics were those individuals who had a score on the PPC which was greater than two standard deviations above the mean score. Those respondents who had a score between the mean score plus two standard deviations and the mean score plus one standard deviation were identified as "potential linkers." The area between the mean score plus one standard deviation and the mean score minus one standard deviation was referred to as the non-discriminating majority. Those respondents with a score between the mean score minus one standard deviation and the mean score minus two standard deviations were labeled potential stabilizers; while a respondent with a score less than two standard deviations below the mean score was characterized as a stabilizer (a graphical representation of the above categorization is shown in Figure 5).



$\bar{X}$ = mean score

S = standard deviation

Figure 5. Categorization of the Population Assuming a Normal Distribution

Linkers were those having a high score, and stabilizers were those having a low score. Potential stabilizers and potential linkers and the non-discriminating majority were distributed between these limits as indicated.

Using this classification scheme, the trial was divided into five groups: linkers, potential linkers, non-discriminating majority, potential stabilizers, and stabilizers. The linkers' and potential linkers' responses to the PPC were grouped and analyzed by question. Similar grouping and analyzing was done for the stabilizers and potential stabilizers. Finally, the responses from the two groups were compared so as to ascertain whether or not individual questions were accurately discriminating. From this analysis, it was apparent that questions 3, 10, 16, and 18 in the PPC were not differentiating with respect to the linkers and stabilizers. Consequently, questions 3, 10, 16, and 18 were omitted from the composite score. The deletion of these four questions from the summation process necessary to derive the composite score and the resultant change in the mean score and standard deviation produced minor variations in the individual composition of the five linking groups.

Now that the trial had been divided into five groups, the respondents identified as linkers and stabilizers, those potential linkers with high scores, and those potential stabilizers with low scores were administered the Oral Linker Census. The number of respondents who were interviewed was 17. As a result of the oral interview each respondent was subjectively given a score on the OLC according to previously mentioned scoring system. Correlation between the score on the OLC and the score on the PPC was extremely high except in one case. In this instance, the individual's score on the PPC indicated he was an "above-average" potential linker, whereas his score on the OLC indicated he was a "below-average" potential linker approaching the non-discriminating majority. Resolution of the inconsistent scores indicated that an apparent weakness in the PPC was its unintentional bias toward self-generated inventive behavior. In other words, a respondent whose behavior closely paralleled that of an inventor who creates or develops new ideas rather than an innovator who

is the earliest adopter of new ideas could obtain a relatively high score on the PPC even though he actually exhibited an extremely low propensity to transfer knowledge. Adjustments were made in the PPC so that it could properly discriminate such behavior by making the questions concerning information transfer (5, 7, 8, 11, and 15) more explicity.

Revision of the Professional Preference Census

Since the purpose of the trial sample was to refine both the PPC and the OLC, several modifications were made to both of the questionnaires prior to administering them to the entire CEC. The Revised Professional Preference Census (RPPC) [see Appendix Three] not only eliminated questions 3, 10, 16, and 18, but also added three new questions and extensively altered all but four of the remaining questions in the PPC (6, 9, 17, and 19).

Question one was changed from one concerning annual income expectations to: "Assuming that you were to make the Navy a career, what would be the highest rank to which you would aspire?" The basis for the question was the same; only the method of determining "higher individual aspirations" was changed. The basic reason for the alteration was that the rigidity of the military income structure tended to bias the responses toward those individuals who did not intend to make the Navy a career. As a result, "career aspirations" appeared to be an indicator which would equate the military and civilian environments without a structured predisposition for a particular response.

Only minor changes were performed on question two. The alterations involved making the responses more explicit with respect to the respondents interpretation of particular phrases, e.g., "associated staff" was used rather than "colleagues" so as to purposefully limit the number of potential definitions associated with the word "colleagues." Similar modifications were per-

formed on question fourteen in the PPC, which was re-numbered as question eighteen in the RPPC.

The change in question three in the RPPC involved making the actual question more specific, i.e., "work-related developments in my professional area" was used in place of "things." The latitude in interpretation which "things" allowed caused some confusion in the individual's response to the question. The use of the general term "things" led to misleading results because of the following two reasons: (1) the census was designed to identify linkers functioning as a linker in general because it is not known whether or not such an individual exists; and (2) the earlier knowing of an innovation is not a generalized trait which pervades all knowledge.

Question four in the RPPC ("In the past year, how many nonroutine, work-related projects have been completed for which you supplied the original idea?") was an addition to the census. Its inclusion in the RPPC was based upon the definition of an innovator as the earliest adopter of an idea or system of thought which the individual, or organizational entity to which he is a member perceives to be new. Even though the innovator is usually not a "creator" in the inventive sense of the word, it was hypothesized that the number of nonroutine, work-related projects for which an individual supplied the original idea would be a measure of the respondent's innovativeness. Hence, the innovator, being eager to try new ideas, would instigate and complete a greater number of projects for which he supplied the original idea than would the later adopter of an innovation. The impetus for the above reasoning was a direct consequence of the results from the OLC interviews with the respondents which the PPC categorized as linkers.

Two modifications were made to question five: (1) "meetings" was explicitly defined as "meetings and/or conventions which involved personnel

other than your immediate circle of colleagues," and (2) the range of the possible responses was reduced. Questions eight and fifteen (nine and sixteen, respectively, in the RPPC) had similar alterations. In eight, the word "colleagues" was replaced with "subordinates, peers and/or superiors" because of the variety of interpretations which "colleagues" elicited. Also, the reason for the individual coming to the respondent was clarified by adding the phrase: "which was not a function of your formal position" after "advice." In question fifteen, the intent of the question was broadened by using "specific item of interest, e.g., journal article, research report, or a lead to either" rather than "a specific journal and/or magazine article." The alterations did not change the basis for the questions, but only attempted to reword them in order that the responses accurately discriminate on the basis of the research. In addition, both question's choice of frequencies was changed as a result of the trial samples responses and comments. Response frequencies were also changed for questions seven and ten in the RPPC.

Question eleven in the RPPC ("Indicate the number of technical, scientific, and/or professional societies to which you hold current membership.") was added to the census in place of question sixteen in the PPC which dealt with the number of miles the respondent traveled. The basis for question eleven was the same as for question sixteen, i.e., cosmopoliteness. Since a dominant characteristic of the gatekeeper, opinion leader, innovator, and early knower is his general orientation to things outside his own group, it was agreed that membership in external societies, groups, etc. would be a viable indicator of the respondent's cosmopoliteness. As previously mentioned, research has shown that a linker is more likely to belong to special organizations because of his tendency to expand his interests and activities beyond the local environment. Thus, the basis for the question remained the same; only the means for utiliz-

ing this basis changed.

Question thirteen in the RPPC was added as a result of the somewhat perplexing responses the linkers and stabilizers in the trial sample gave to question fourteen in the PPC, which asked the respondent to characterize his approach to an innovative idea. The data from question fourteen in the trial sample indicated a trend which was exactly opposite to that which we hypothesized, i.e., in general, the linkers perceived themselves to not be as venturesome as the stabilizers perceived themselves to be. Recalling that venturesomeness is defined as the willingness to take risks in the adoption of a new idea, product, etc., the linker should exhibit a tendency to be venturesome, while the stabilizer should exhibit a predisposition to use only proven ideas. With question fourteen displaying the reversed phenomenon, research was conducted to explain the apparent discrepancy. Blackwell [p. 19] had conducted research on the characteristics of the innovator which offered mitigating evidence. His findings indicated that innovators differed significantly on the following characteristics when compared with the population in general: "greater willingness to experiment with new ideas, more prone to buy new products earlier, a greater tendency to be rational and logical . . ." Additional research has also shown the innovator to exhibit "greater rationality than later adopters," [Rogers and Shoemaker, p. 188]. The presence of these counterbalancing attributes of rationality and venturesomeness could have been a contributing factor in the distribution of responses to question fourteen. Consequently, question fourteen was slightly modified for use in the RPPC and an additional question (number thirteen) was developed which would recognize the presence of both characteristics.

Question thirteen was another situational type of question (similar to number seventeen and nineteen in the PPC) in which the respondent was asked to

"Indicate which of the following would best describe his approach to the building material" if he were Mr. C. The situation dealt with a new building material which was used extensively in Europe but had never been adopted in the United States. It was assumed that the respondent would project his attitude toward the new building material into Mr. C.'s situation. The content of the question was designed to account for both venturesomeness and greater rationality while maintaining its efficacy as a discriminating implement.

An analysis of the responses to question eleven in the PPC did not indicate any marked differences between the linkers and stabilizers. The reason for such non-discrimination was felt to be due to the interpretation of both the question and the five alternative choices. To alleviate the interpretative problems, the question was made more definitive by specifying that the source of information was "for work-related projects and/or problems." Further, the five alternatives were explicitly defined so as to minimize the possibility of misconstruing the intended meaning.

Question twelve in the PPC also had a definitive problem in that there was a wide range of misunderstanding with respect to the definition of a primary reference group. The problem surfaced during the oral interviews in response to a similar question in the OLC. Here the problem was elucidated as not only definitional, but also a function of the fact that the membership in the groups offered as choices in the written question were not mutually exclusive. To alleviate the problems, the question was reworded ("Indicate the group of people to whom you primarily relate") and the groups within the alternatives were classified differently.

At this point all of the questions appearing in the Revised Professional Preference Census have been discussed. The four questions from the original PPC (number 3, 10, 16, and 18) which were not included in the RPPC will now be

examined with respect to the characteristic upon which they were to have discriminated. Question three ("At the present time if you had to place yourself in one of the following social classes, which would you choose?") was omitted because it was impossible for the question to compare social status between the two groups, e.g., between the early adopter of an innovation and the later adopter. The question asked for an absolute valuation when a relative valuation was needed between the linker type and the non-linker type. Question ten ("Indicate the dollar budget for which you have control at your present billet") was eliminated because it appeared that within the military environment there was not a high degree of correlation between innovative characteristics and the monetary responsibility of the billet. Since the trial indicated that linkers and stabilizers were distributed throughout the continuum of rank and billet descriptions, and that the distribution of responses to question ten was essentially the same throughout the linker categories, question ten was omitted. Question sixteen's omission has already been explained. The eighteenth question in the PPC ("Indicate which of the following does not describe a new product or new process") was not included in the RPPC on the basis that the responses from the trial sample indicated that the question was not discriminating with respect to early knowing of an innovation. It appeared that question eighteen was more a measure of one's technical expertise than it was a function of whether the respondent had heard of the innovation. From the above question it was apparent that specific topic, processes, etc. could not be utilized as discriminating tools when dealing with a population which was located in a vast array of organizational settings. The results would be a random selection because a question general enough to be meaningful would not be able to distinguish between groups. The four questions which were omitted from the RPPC did not tend to discredit the research presented as their basis; but rather

indicated that our attempt to capitalize upon the past research with a self-identifying question was not successful because of two main problems: (1) the construction of the question; and (2) the nature of the audience.

Revision of OLC

In addition to improving the PPC as a result of the presurvey field testing, we also refined the Oral Linker Census. The revised OLC, entitled the Linker/Stabilizer Validity Census (LVC), contained eleven open-ended questions which asked the interviewer to describe events which explicitly explain his existing role in transferring technology from source to use [see Appendix Four]. Five new questions were added to the LVC, while the six questions from the OLC were extensively modified so as to develop a valid instrument for obtaining in-depth information from the individual identified as a linker or stabilizer. The presurvey indicated that the oral interview required a greater number of questions which dealt directly with information transfer vice information transfer which was a consequence of the innovative process. Hence, the five questions which were added were basically extensions of the written questions in the RPPC, which directly explored information transfer; e.g., question ten in the LVC asks: "Can you recall the most recent instance in which you sought information about a new idea or ideas which you thought to be useful to your work?" If the individual replies "yes" a series of open-ended questions are asked so as to provide a basic structure for the respondent to describe the incident. As before, the incident and its resultant description are subjectively evaluated by the interviewer with the same scoring method used in the OLC. The score for each of the eleven questions is summed to arrive at the total score for the respondent being interviewed. The score on the LVC will then be compared with the composite score on the RPPC so as to arrive at a necessary measure of validity for the preference census.

Administration of RPPC and LVC

The Revised Professional Preference Census was administered to all officers within the Civil Engineer Corps (sample size of 1726). The RPPC was mailed to each officer with basic instructions as to how to complete the census. It was explained in the cover letter that the accuracy and validity of the responses would be impaired if explanatory information was included concerning the purpose of the RPPC. As a result, the cover letter was a terse instructional statement which requested their assistance and cooperation in completing and returning the census at their earliest possible convenience.

The response to the RPPC was far better than expected. The number of questionnaires was arbitrarily cut off in order that sufficient data analysis could be performed prior to the preparation of the final report. At the cut-off point 1128 questionnaires had been returned. This constituted a response rate of 76 per cent [calculated by: 1128/(1726-N) where N equals those questionnaires which were returned without a response; N equaled 47 at the cut-off point]. Since a 40 per cent or better response is considered exceptional in population surveys [Lansing, p. 83], the assumption was made that the sample size of 1128 was representative of the CEC.

Statistical error usually includes both bias and random error. Statistical bias, being caused by improper sampling techniques, was not a direct factor in the data derived from the RPPC because it was a population survey vice a sample survey. Random error, being an error which is subject to chance, was present in the sample derived from the population survey. If the assumption is made that there is equal probability of each officer in the CEC returning the RPPC, the standard error of the population mean can be estimated. The standard error of the sample mean is an estimate of the standard error of the population mean, which in turn is a measure of how much the sample mean varies from the true

value of the population mean due to random error. Upon calculating the standard error for the response sample [see Appendix Five for the computation of the standard error of the sample mean score], it was apparent that the size of sample had considerably reduced the magnitude of possible random error. Specifically, the magnitude of possible random error, measured in both directions from the sample mean of 48.66 was 0.27 at a confidence level of 99 per cent. This indicated that a score would be significant if it were greater than 48.93 or lower than 48.39. Consequently, the assumption that the sample size of 1128 was representative of the population of Civil Engineer Corps officer was accepted.

The scoring of the RPPC and the initial method of categorizing the respondents from the final sample was the same as that which was employed in the trial sample. Histograms of the responses to each question were prepared for the total sample, the linkers, the linkers and potential linkers, the stabilizers, and the stabilizers and potential stabilizers. Analysis of these histograms indicated that questions fourteen and fifteen were not discriminating with respect to the linker categories. As a result, both questions fourteen and fifteen were eliminated in the determination of the individual's composite score on the RPPC. After deletion of questions fourteen and fifteen, the final sample was again dichotomized into the five linker categories.

The categorization of the final sample produced linker and stabilizer groups which were unequal. Upon observation of the distribution of composite scores (excluding questions 14 and 15) for the total sample [see Appendix Six for a histogram of the individaul scores after deletion of questions 14 and 15], it appeared that the groups were unequal because the distribution was slightly asymmetrical.

Distribution Analysis

A Chi-square goodness-of-fit test was performed at this point to determine whether the sample distribution agreed with the normal distribution [see Appendix Seven for an explanation of the test]. The test indicated that the sample distribution was not normal primarily because (1) the sample distribution dropped moderately after the mean; and (2) the upper tail was abnormally long. To compensate for the slight asymmetry in the sample distribution, the method of categorizing the respondents was modified so that the groups would be equalized with respect to the actual distribution. The modification involved changing the constant with which the standard deviation was multiplied from two (2.00) for linkers and stabilizers and one (1.00) for potential linkers and potential stabilizers to 1.83 and 0.93 respectively. Such a method of classifications tended to create groups which were more indicative of the sample distribution than the arbitrary method did based upon an assumption of normality. The refined method of classification produced the following sub-sample sizes: 41 linkers, 132 potential linkers, 797 non-discriminating majority, 118 potential stabilizers, and 30 stabilizers.

RPPC Discrimination Analysis

Now that the final sample was classified into groups, the responses per question for the linkers and stabilizers were analyzed so as to determine the degree of discrimination with respect to the hypothesized attributes of both groups. Histograms were prepared for the linkers and stabilizers for each question so that visual observations could be made as to the degree of discrimination [see Appendix Eight for the linkers' histograms and Appendix Nine for the stabilizers' histograms]. In addition, a Chi-square test was performed to determine the significance of differences between the linkers and stabilizers

for each question in the RPPC. [See Appendix Ten for an explanation of the methodology and the actual computations.] A summarization of the results of the Chi-square test is presented in Table One. As shown in Table One, the response to each question was significantly different for the linkers and stabilizers except for question fourteen and fifteen which had previously been deleted for scoring purposes anyway.

Based upon the statistical analysis in Table One, it is apparent that the RPPC is a discriminating instrument. But an attempt to conclude from the data that a particular group tended to answer a question in a particular manner was not done because the census was designed to identify individuals who were functioning as linkers based upon predetermined conclusions as to what their responses would be. Consequently, the only conclusion which can be made with respect to the aggregate responses of the two groups is that the RPPC did identify two samples which had significantly different characteristics. Whether the group which was hypothesized to be linkers was in fact composed of individuals who exhibit the identifying attributes of a linker type was a question which the RPPC could not answer because of the inherent characteristics of the census. Further statistical analysis was therefore directed at determining the discriminating properties of the RPPC.

RPPC Multiple Discriminant Analysis

A multiple discriminant analysis was employed to test the multivariate ability of the RPPC to discriminate linkers and stabilizers from the sample population. The analysis was also used to rank the 18 individual questions in order of their relative importance as discriminators of individual respondents. BMD07M (Stepwise Discriminant Analysis), one of the Biomedical Computer Programs, was used to develop the discriminant function [Dixon, p. 244A-t].

	Question	χ^2 Test Statistic	χ^2 Critical Value for 0.95	Degrees of Freedom	Accept Independence Hypothesis?
1.	Assuming that you...	42.51	11.10	5*	Yes
2.		22.91	9.49	4	Yes
3.		43.68	9.49	4	Yes
4.		67.08	11.10	5	Yes
5.		52.23	9.49	4	Yes
6.		45.87	9.49	4	Yes
7.		55.54	9.49	4	Yes
8.	Situational question assessing the respondents perceived tendency to enter into a credit relationship.	16.07	9.49	4	Yes
9.		46.96	11.10	5	Yes
10.		51.64	9.49	4	Yes
11.		43.10	9.49	4	Yes
12.		49.06	11.10	5	Yes
13.	Situational question assessing the respondent's perceived degree of venturesomeness.	19.68	9.49	4	Yes
14.		3.43	9.49	4	No
15.		2.04	9.49	4	No
16.		51.75	9.49	4	Yes
17.	Situational question assessing the respondent's perceived tendency to assume risk.	30.18	9.49	4	Yes
18.		29.20	11.10	5	Yes

* Degrees of freedom (df) = (r-1)(K-1), where r = the number of rows and K = the number of columns in the contingency table. The number of columns (linkers' and stabilizers' responses) are constant throughout the analysis whereas the number of rows varied according to whether an individual indicated a non-response (scored as zero) to a particular question.

Table 1. List of χ^2 Values for Linkers vs Stabilizers

A χ^2 test was performed to determine the usefulness of each question as a discriminator. All of the questions except number 14 and number 15 showed a significant value for χ^2 at the 95% confidence level.

The first step in the analysis was to combine the five previously defined groups into three groups. The first group consisted of the 158 respondents who were previously categorized as stabilizers and potential stabilizers. The second group consisted of the 173 respondents who were previously categorized as linkers and potential linkers. The third group consisted of the remaining 797 respondents. The rationalization for this apriori grouping was based on the fact that the number of linkers and stabilizers (41 and 30, respectively) without their potential counterparts would not provide large enough groups for analysis.

The second step in the analysis was to take each of the three individual groups and compute a linear discriminant function of the original 18 questions which best characterized the multivariable distribution of that group. The three discriminant functions when computed served to discriminate the entire sample population of 1128 respondents. [See Appendix Eleven for the three discriminant functions computed for each group.]

The final step in the analysis was to pool the three groups disregarding the original information about prior group membership. Each of the 1128 respondents scores was then evaluated by each of the three discriminant functions. Based on the highest score over the three discriminant functions the individual respondent was categorized into one of the previously defined groups [see Appendix Eleven for the group breakdown].

Perfect discrimination would have grouped the 1128 respondents exactly as apriori grouping, that is, 158 stabilizer types, 173 linker types and 797 others. Reference to Table 1 of Appendix Eleven illustrates the fact that the discrimination was something short of perfect. The discriminant functions grouped the respondents as 236 stabilizer types, 208 linker types and 685 others. Since multivariate analysis is a statistical procedure, perfect discrimination is highly unlikely. The minor deviation in the results was certainly acceptable

within the constraints of the problem. That is, within the constraints of a multivariable analysis of 18 questions certain respondents will score equally well in adjacent groups. This phenomena is graphically illustrated in Figure One, Appendix Eleven. The overlap is primarily caused by the apriori grouping of the respondents. The fact of the matter is that the RPPC was able to discriminate linkers and stabilizers from the sample population.

One of the most useful applications of discriminant analysis is in the area of prediction. Once the discriminant functions have been calculated, they may be used to group future RPPC respondents. If a respondent's score on each question $(X_1 \ldots X_{18})$ is substituted into each of the three discriminant functions one can determine which group os appropriate by simply choosing the largest value of D.

The analysis also provided a ranking of the questions in order of their ability to discriminate. Basically, the multiple discriminant analysis was performed in a stepwise manner. At each step one question is entered into the set of discriminating functions. The question entered is selected by the first of the following equivalent criteria:

1. The question with the largest F value.
2. The question which when partialed on the previously entered questions has the highest multiple correlation with the groups.
3. The question which gives the greatest decrease in the ratio of within to total generalized variances.

A question is deleted if its F value becomes too low, i.e., insignificant. [See Table Two for the results of this ranking.] The results agreed with the earlier finding that Questions 14 and 15 were insignificant as discriminators. The exceedingly large F values of Questions 16 and 4 indicate that a large proportion of the RPPC's ability to discriminate is a function of these questions. However, the F value of the remaining 14 questions acted as a "fine tuner" in the discrimination process. 51

Question	F Value
16	203.12
4	114.73
10	80.15
6	47.68
11	47.33
2	43.53
12	46.38
9	37.49
18	38.85
8	32.77
1	34.93
7	24.76
5	24.80
17	25.55
3	18.18
13	17.46
15	.77
14	.61

Table 2. Rank of 18 Questions in Terms of Discrimination of Linkers vs Stabilizers

The questions are ordered in terms of F value, multiple correlation within groups and greatest decrease in ratio of within to total generalized variance.

Discriminant Analysis of Military Rank

Multiple discriminant analysis was also used to test the ability of the RPPC to discriminate military rank among the individual respondents. The initial thought was that junior officers would be more prone to function as stabilizers because they are usually not in a position to function as linkers. Reference to Table Two, Appendix Eleven, illustrates the fact that in many cases the discrimination was poor at best. This fact is perhaps better illustrated by the graphical depiction in Figure Two, Appendix Eleven. The "$" in this plot indicates overlap in response.

The reason for this inability to discriminate military rank can be explained in part by the existence of a confounding variable in the analysis. This variable is time. For example, the difference in experience between Ensigns and Lieutenant junior grades can be very difficult to quantify. This characteristic showed itself continuously in the analysis of all the various ranks.

In short, the RPPC was not able to discriminate military rank. This was a favorable indicator that the census was not biased toward the rank structure.

Validity of the Revised Professional Preference Census

The validity of a questionnaire depends on the extent to which it measures what it purports to measure. Since the RPPC was designed as an instrument to identify the individual functioning as a linker in the Civil Engineer Corps, a measure of its validity was whether the respondent which it identified as an individual possessing linker characteristics was in fact a linker. To substantiate whether or not this individual was functioning as a linker could only be done using an independent method of measurement. Such was the purpose of the Linker/Stabilizer Validity Census.

The LVC was administered to those CEC officers identified as linkers and to those identified as stabilizers whose billet assignments were not on the West Coast, and were not beyond the continental United States. The reason for eliminating linkers and stabilizers on the West Coast from the initial administration of the LVC was based on the fact that if it were necessary to interview the entire population of linkers and stabilizers, those which involved considerable travel would have already been interviewed. Interviewing propective linkers and stabilizers out of the continental United States involved an excessive cost which could not be justified since an adequate sample was available within the continental boundaries of the United States. As a result, 18 of the 30 linkers in the continental United States (60 per cent) and 9 of the 22 stabilizers in the continental United States (41 per cent) were administered the LVC. The selection of the samples did not involve any apparent bias, since the criterion was based on geographical location and there had not been any research which indicated that linker characteristics were influenced by geography.

The method of subjectively scoring the LVC was the same as that method utilized in the OLC. Once the scores were obtained they were compared to the individual's corresponding RPPC score utilizing a Kolmogorov-Smirnov two-sample test [see Appendix Twelve for the methodology and computations involved in the K-S test]. From the Kolmogorov-Smirov test, it was apparent that the subjective score on the LVC and the composite score on the RPPC came from the same distribution. These results lead us to the conclusion that the RPPC did identify individuals which were functioning as linkers in the Civil Engineers Corps.

Conclusion

The thrust of this years effort was to investigate the possibility of isolating and identifying an index that would display a high correlation with the research and development output utilization efficiency of an organization.

This research began by an extensive study of pertinent literature. The extent of the literature dealing with technology transfer and technology utilization far exceeded expectation.

It is safe to say that there are several thousand books and articles which deal directly with this subject. Major contributors that were working in the specific area of our interest were identified and a personal relationship was developed with several fellow researchers. For example, this project has utilized the work of Everett M. Rogers of Michigan State University and Ronald G. Havelock of the University of Michigan very extensively during the formulation stage.

The model shown as Figure 2 on page 5 was developed essentially independent of the literature research. As the literature research progressed it became apparent that there was a great deal of commonality between the model that we had formulated and similar models presented by others in the literature. Such a discovery tended to reinforce our effort and served as a validity test of early hypotheses.

It was apparent early in the research that it would not be feasible to investigate more than one factor of the model during this year of research.

The selection of the factor called "Linker" was the result of a logical assessment of the estimated relative value of each factor and the probability of developing an instrument to measure that factor.

The linker as used in this research is somewhat different than found in the literature and has similar identifying traits and characteristics as those of the gatekeeper, opinion leader, innovator, and early knower of an innovation.

Once the concept of the linker was formulated it was then hypothesized that there is a relationship between output efficiency utilization of research and development and the behavioral characteristics of the individuals in the user organization.

In order to test the hypothesis it was necessary to develop a methodology for identifying the persons performing as "linkers" and the persons performing in the opposite polar position which we chose to call the "stabilizers."

The methodology adopted was a self administered questionnaire with a combination of questions dealing with role performance and perceived roll performance, and questions designed to utilize image projection.

The statistical analysis of the effectiveness of the measuring instrument, the Professional Preference Census, indicated a high degree of validity. The PPC was very effective in identifying those persons performing as "linkers" and those persons performing as "stabilizers."

Suggested Further Research

One of the most important limitations of the measuring instrument developed during this research is the fact that a well informed individual could heavily bias his answers. This suggests that the instrument has limited use as a longitudinal instrument. This limitation further suggests that it would be appropriate to devise a companion instrument that could be used for longitudinal studies. One possible suggestion is an instrument similar to the Strong Vocational Preference Test. Such a test would not eliminate an overt bias, but it would tend to reduce the bias error when there was not a planned attack upon the instrument.

From what is now known about the identifying traits and characteristics of the linker and stabilizer it seems evident that most positions in the user organization could be classified. Also from what is now known it would seem

that selective placement of linkers and stabilizers in the user organization could lead to an enhancement of the research and development utilization efficiency.

The model that was developed during this research project consists of some nine factors. Prior research sponsored by NAVFACENGCOM at the Naval Postgraduate School and at other locations has investigated the factors, Method of Information Documentation [DOCU], Distribution System [DIST] and to some extent Credibility as Viewed by the Receiver [CRED]. It is possible that there is sufficient research data available to develop the θ and C coefficient for these factors.

This logically leads to a recognition that there are several factors of the model that have not been investigated in terms of a measuring instrument and their relative importance to the model in terms of assigning values to θ and C.

In summary, then, the research as presented in this report suggests that the work to date has been very meaningful and may have several short term and long term practical applications. Further, the research to date strongly suggests that a continued effort built upon the research as herein reported could be productive in terms of a better understanding of methods of enhancing research and development utilization efficiency.

BIBLIOGRAPHY

Bibliography

1. Allen, Thomas J., "The Differential Performance of Information Channels in the Transfer of Technology," Working paper for Alfred P. Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Mass., June, 1966.

2. Allen, Thomas J., "Performance of Information Channels in the Transfer of Technology," Industrial Management Review, VIII (1966), pp. 87-98.

Baker, W. O., et. al., Improving the Availability of Scientific Information in the United States, Panel Report of the President's Science Advisory Committee, December 7, 1958.

Bales, R. F., et. al., "Channels of Communication in Small Groups," American Sociological Review, XVI (June 1963), pp. 2-7.

Barnett, H. G., Innovation: The Basis of Cultural Change. New York: McGraw-Hill Book Company, 1953.

Bell, W. E., "Consumer Innovators: A Unique Market for Newness," in Proceedings of the Winter Conference of the American Marketing Association. New York: 1963.

Bennis, Warren G., Kenneth D. Benne, and Robert Chin, The Planning of Change, New York: Holt, Rinehart and Winston, 1962.

Berenson, Conrad, "The R & D: Marketing Interface -- A General Analogue Model for Technology Diffusion," Journal of Marketing, XXXII (April, 1968), pp. 8-15.

Blackwell, Roger D., "Word-of-Mouth Communication by the Innovator," Journal of Marketing, XXXIII (July, 1969), p. 19.

Brooks, Harvey, The Government of Science, Cambridge: The M.I.T. Press, 1968.

Brown, Emory J., and Albert Deckens, "Role of the Extension Subject Matter Specialist," Rural Sociology, 1958, Vol. 23, No. 3, pp. 263-276.

Buzzell, Robert D., Cox, Donald F., and Brown, Rex V., Marketing Research and Information Systems. New York: McGraw-Hill Book Company, 1969.

Carter, Charles F., and Bruce R. Williams, Industry and Technical Progress: Factors Governing the Speed and Application of Science, London: Oxford University Press, 1957.

Churchill, Gilbert A., and Ozanne, Urban B., "Adoption and Diffusion Research: A Potential Tool for Improving Technology Transfer," (an unpublished paper, 1967).

Clearinghouse for Federal Scientific and Technical Information, Technology Transfer and Innovation: A Guide to the Literature, (August, 1966), PB-170-991, STS104.

Coleman, James, Katz, Elihu, and Mensel, Herbert, "The Diffusion of an Innovation Among Physicians," Sociometry, Vol. 20 (December, 1957), pp. 253-270.

Crawford, J. H., et. a., Scientific and Technical Communications in Government, Task Force Report to the President's Special Assistant for Science and Technology, April, 1962, AD-299-545.

Cox, Donald F., ed. Risk Taking and Information Handling in Consumer Behavior. Boston: G. S. B. Harvard Univ., 1967.

Diehl, R. W., "Achieving Successful Innovation," Michigan Business Review, XXIV (March, 1972), pp. 6-10.

Dixon, W. J. (Ed.) BMD Biomedical Computer Programs. Los Angeles, Calif.: University of California Health Sciences Computing Facility, 1968.

Doctors, Samuel, "Technology Utilization: NERAC Service," Industry, XXXII, No. 11 (November, 1966), pp. 33, 89.

Doctors, Samuel I. The Role of Federal Agencies in Technology Transfer. Cambridge: M.I.T. Press, 1969.

Engel, James F., Blackwell, Roger D., and Kegerreis, Robert J., "How Information Is Used To Adopt an Innovation," Journal of Advertising Research, IX (September, 1969), p. 4.

Essoglou, Milan E., "Technology Transfer: Mature Industry and Institutionalized Organization," Master's thesis. Washington, D. C.: George Washington University, November, 1969.

Farr, Richard S., "Knowledge Linkers and The Flow of Educational Information," an unpublished paper. Stanford: Stanford University, 1969.

Foster, Richard N., "Organize for Technology Transfer," Harvard Business Review, II (November-December, 1971), pp. 110-120.

Gilmore, John S. "The Environment and the Action in Technology Transfer: 1970-80," in a Report of a Conference sponsored by Denver Research Institute, University of Denver called Snowmass-at-Aspen, Sept. 26-28, 1969, Washington, D. C. Dept. of Commerce N70-26339, 1969.

Goldman, J. E., "Role of Science in Innovation," Proceedings of A Conference on Technology and Innovation, National Science Foundation Report 67-5, 1967, pp. 92-95.

Green, Paul E., "Measurement and Data Analysis," Journal of Marketing, XXXIV (January, 1970), pp. 15-17.

Gruber, William H., and Marquis, Donald G., ed. Factors in the Transfer of Technology. Cambridge, Massachusetts: The M.I.T. Press, 1969.

Gruber, W. H., and Marquis, D. G., "Research on the Human Factor in the Transfer of Technology," in William H. Gruber and Donald G. Marquis, ed. Factors in The Transfer of Technology. Cambridge, Mass.: M.I.T. Press, 1969.

Hagerstrand, Torsten, "A Monte Carlo Approach to Diffusion," European Journal of Sociology, Vol. 6 (1965), pp. 43-67.

Haney, William V., Communication Patterns and Incidents. Homewood, Illinois: Irwin, 1960.

1. Havelock, R. G., et. al., Planning for Innovation Through Dissemination of Utilization of Knowledge. Ann Arbor, Michigan: Institute for Social Research, Univ. of Michigan, 1971.

2. Havelock, Ronald G., "Linking Research to Practice: What Role for the Linking Agent?" Paper presented at the American Educational Research Association Meeting, New York, February, 1967.

3. Havelock, Ronald G., and Benne, Kenneth D., "An Exploratory Study of Knowledge Utilization," in G. Watson, Concepts for Social Change, Washington, D. C.: NTL Institute for Applied Behavioral Science, 1967.

Jung, Charles, "Two Kinds of Linkage for Research Utilization in Education," Paper presented at the American Educational Research Association, New York, February 16, 1967.

1. Katz, Elihu, "The Two Step Flow of Communications: An Up-to-Date Report on an Hypothesis, The Public Opinion Quarterly, XXI (Spring, 1957), p. 77.

2. Katz, Elihu, "The Social Itinerary of Technical Change: Two Studies on the Diffusion of Innovation," Human Organization, XX (Summer, 1961), p. 78.

3. Katz, Elihu, et. al. "Traditions of Research on Diffusion of Innovation," American Sociological Review, XXVIII (April, 1963).

King, Charles W., "Adoption and Diffusion Research in Marketing: An Overview," in Science, Technology, and Marketing: Proceedings of the Fall Conference of the American Marketing Association. New York: American Marketing Association, 1966.

King, Charles W., "Technology, Innovation, and Consumer Decision Making," in Proceedings of the Winter Conference of the American Marketing Association. New York: American Marketing Association, 1967, pp. 63-8.

Klein, B. H., et. al. Military Research and Development Policies. Santa Monica, California: Rand Corporation, 1958.

Lambert, Zarrel V., "Information Handling Among Consumer Innovators and Non-Innovators," in Combined Proceedings: 1971 Spring and Fall Conference of the American Marketing Association. New York: American Marketing Association, 1972, pp. 439-443.

Lamont, Lawrence M., Technology Transfer, Innovation and Marketing in Science Oriented Spin-off Firms. Ann Arbor: Institute of Science and Technology, the University of Michigan, 1971.

Lansing, J. B., et. al. An Investigation of Response Error. Urbana: University of Illinois, 1961.

Lazarsfeld, Paul F., et. al. The People's Choice. New York: Duell, Biloan, Pearce, 1948.

Lesher, Richard L., and Howick, George J., Assessing Technology Transfer. Washington, D. C.: NASA, 1966.

Lewin, Kurt, "Forces Behind Food Habits and Methods of Changing," in Report of the Committee on Food Habits, The Problem of Changing Food Habits. Washington, D. C.: National Research Council, National Academy of Sciences, 1943.

Lewin, Kurt, "Group Decision and Social Change," in G. E. Swanson, et. al., Readings in Social Psychology (New York: Holt and Company, 1952), p. 199.

Lippitt, Ronald, Watson, Jeanne, and Westly, Bruce, The Dynamics of Planned Change, New York: Harcourt, Brace and Co., Inc., 1958.

Lipset, Seymour M., and Bendix, Reinhard, Social Mobility in Industrial Society. Berkeley: University of California Press, 1959, p. 1.

Little, Arthur D., Inc., Technology Transfer and the Technology Utilization Program, Report to the National Aeronautics and Space Administration, 1965.

Mancuso, Joseph R., "Why Not Create Opinion Leaders for New Product Introductions?," Journal of Marketing, XXXIII (July, 1969), pp. 20-25.

Mansfield, Edwin, "Technical Change and the Rate of Imitation," Econometrica, Vol. 29 (October 1961), pp. 741-766.

Marquis, Donald G., and Allen, Thomas J., "Communication Patterns in Applied Technology," American Psychologist, Vol. 21(1966), pp. 1052-1060.

Martin, George, and Willens, R. H., ed. Coupling Research and Production. New York: Interscience Publishers, 1967.

Massey, "Information Requirements for Contract Defense Mission-Oriented Basic Research Investment Decisions," Ph.D. dissertation. Washington, D. C.: American University, 1967.

McDonough, Adrian M., Information Economics and Management Systems. New York: McGraw-Hill, 1963.

Mendenhall, William, et. al. Elementary Survey Sampling. Belmont, California: Duxbury Press, 1971.

Menzel, Herbert, Review of Studies in the Flow of Information Among Scientists, New York: Columbia University, Bureau of Applied Social Research, 1960.

1. Menzel, Herbert, Review of Studies in the Flow of Information Among Scientists, New York: Columbia University, Bureau of Applied Social Research, 1960.

2. Menzel, Herbert, and Katz, Elihu, "Social Relations and Innovations in the Medical Profession; the Epidemiology of a New Drug," Public Opinion Quarterly, Vol. 19 (Winter 1955-56), pp. 337-352.

Miles, Matthew B., Innovation in Education, New York: Bureau of Publications, Teachers College, Columbia University, 1964.

Montgomery, David B., and Silk, Alvin J., "Clusters of Consumer Interests and Opinion Leaders' Spheres of Influence," Journal of Marketing Research, VIII (August, 1971), pp. 317-321.

Morton, J. A., Organizing for Innovation: A Systems Approach to Technical Management. New York: McGraw-Hill, 1971.

Moser, C. A., Survey Methods in Social Investigation. London: Heinemann, 1969.

Morse, Dean, and Warner, Aaron W. (ed.) Technological Innovation and Society. New York: Columbia University Press, 1966.

Muse, William V., and Kegerreis, Robert J., "Technological Innovation and Marketing Management: Implications for Corporate Policy," Journal of Marketing, XXXIII (October, 1969), pp. 3-9.

1. Myers, S., "Industrial Innovations and the Utilization of Research Output," Proceedings of the Twentieth National Conference on the Administration of Research, Denver: Denver Research Institute, University of Denver, 1967.

2. Myers, James H., and Robertson, Thomas S., "Dimensions of Opinion Leadership," Journal of Marketing Research, IX (February 1972), pp. 41-46.

Politz, Alfred, A 12-Month's Study of Better Homes and Gardens Readers. Des Moines, Iowa: Meredith Publishing Co., 1956.

Presser, H. A., "Measuring Innovativeness Rather than Adoption," Rural Sociology, XXXIV (December 1969), pp. 510-527.

Reiss, Howard, "Human Factors at the Science-Technology Interface," in William H. Gruber and Donald G. Marquis, ed. Factors in the Transfer of Technology. Cambridge, Mass.: M.I.T. Press, 1969.

Reynolds, Fred D., and Darden, William E., "Mutually Adaptive Effects of Interpersonal Communication," Journal of Marketing Research, VIII (November, 1971), p. 449.

Riley, John W., Jr., and Riley, Matilda W., "Mass Communication and the Social System," in Robert K. Merton, et. al. Sociology Today: Problems and Prospects. New York: Basic Books, 1959.

Roberts, Edward B., "Entrepreneurship and Technology," in William H. Gruber and Donald G. Marquis, (ed.) Factors in the Transfer of Technology. Cambridge, Mass.: M.I.T. Press, 1969.

Roberts, Edward B., and Wainer, Herbert A., "Technology Transfer and Entrepreneurial Success," Proceedings of the Twentieth National Conference on the Administration of Research, Denver: Denver Research Institute, University of Denver, 1967.

1. Robertson, Thomas S., An Analysis of Innovative Behavior and Its Determinants. Ann Arbor: University of Michigan, 1967.

2. Robertson, Thomas S., "The Process of Innovation and the Diffusion of Innovation," Journal of Marketing, Vol. 31 (January), 1967, pp. 14-19.

Robertson, Thomas S., and Myers, James H., "Personality Correlates of Opinion Leadership and Innovative Buying Behavior," Journal of Marketing Research, VI (May, 1969), pp. 164-78.

1. Rogers, Everett, "Categorizing the Adopter of Agricultural Practices," Rural Sociology, XXIII (1958), pp. 345-54.

2. Rogers, Everett M., "Characteristics of Agricultural Innovators and Other Adopter Categories," in Studies of Innovation and of Communication to the Public, Stanford: Institute for Communication Research, Stanford University, 1962.

3. Rogers, Everett M., Diffusion of Innovators. New York: The Free Press of Glenco, 1962.

Rogers, Everett M., and Jain, Nemi C., "Research Utilization: Bridging the Communication Gap Between Science and Practice," Paper presented at the Joint Session of the Information Systems Division of the International Commerce Association and the Behavioral Science International Group of the Speech Association of America, New York, 1969.

Rogers, Everett, and Rogers, L. Edna, "A Methodological Analysis of Adoption Scales," Rural Sociology, XXVI (1961), p. 330.

Rogers, E. M., and Shoemaker, F. Floyd, Communication of Innovation: A Cross-Cultural Approach. New York: Free Press of Glenco, 1971.

1. Rosenbloom, Richard, Technology Transfer -- Process and Policy, Washington, D. C.: National Planning Association Special Report No. 62, July 1965.

2. Rosenbloom, Richard S., and Wolek, Francis W., Technology and Information Transfer: A Survey of Practice in Industrial Organizations. Boston: G. S. B. Harvard University, 1970.

Rovelstad, James M., The Role of Buyer-Initiated Formal Communication in Marketing R & D to the Government. Ann Arbor, Mich.: Institute of Science and Technology, University of Michigan, 1971.

Schon, Donald A., Technology and Change. New York: Delacorte Press, 1967.

Seymour, M., et. al. Social Mobility in Industrial Society. Berkeley: University of California Press, 1959.

Spencer, Daniel L., Technology Gap in Perspective. New York: Sparton, 1970.

Summers, John O., "Generalized Change Agents and Innovativeness," Journal of Marketing Research, VIII (August, 1971), pp. 313-316.

Summers, John O., "The Identity of Women's Clothing Fashion Opinion Leaders," Journal of Marketing Research, VII (May, 1970), pp. 178-185.

Summers, John O., "Media Exposure Patterns of Consumer Innovators," Journal of Marketing, XXXVI (January, 1972), pp. 43-49.

Summers, John O., "New Product Interpersonal Communications," in Combined Proceedings: 1971 Spring and Fall Conferences of the American Marketing Association. New York: American Marketing Association, 1972, pp. 428-433.

Taube, M., An Evaluation of Use Studies of Scientific Information, Documentation, Inc., December 1958, Ad-206-987.

Thorelli, Hans B., "Concentration of Information Power Among Consumers," Journal of Marketing Research, VIII (November, 1971), pp. 427-28.

Webster, Frederick E., "Informal Communication in Industrial Markets," Journal of Marketing Research, VII (May, 1970), pp. 186-189.

Wentz, Walter B., Marketing Research: Management and Methods. New York: Harcourt, Brace Jovanovich, Inc., 1972.

White, W. James, "A Functional Model of the Adoption-Rejection Process," A Paper presented to the Rural Sociological Society, San Francisco, 1969.

Wilkening, Eugene A., "Roles of Communicating Agents in Technological Change in Agriculture," Social Forces, XXXIV (May 1956), pp. 361-367.

Znaniecki, Florian, The Social Role of the Man of Knowledge, New York: Columbia University Press, 1940.

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Appendix One

Appendix One contains two documents: (1) the first is the letter that was sent with the Professional Preference Census and (2) the first Professional Preference Census that was employed.

The intent of the first PPC was to test the questions and to gather information for modification where necessary.

Appendix One

NC4(Cf)/veh
24 January 1972

MEMORANDUM

From: Dr. J. W. Creighton
Dr. J. A. Jolly
Lt(jg) S. A. Denning

To:

Encl: (1) Professional Preference Census

The attached census is being distributed to you in order that you may both complete and evaluate it prior to its utilization on a much larger sample within the Navy.

Even though the majority of the questions are not related to your assignment here at the Naval Postgraduate School, we would ask you to attempt to answer the entire census in the context of your last duty station. When the census is utilized on the much larger sample, it will be administered only to officers at an applicable duty station. Consequently, the administration of the census here at the Naval Postgraduate School is somewhat unrealistic and is primarily aimed at obtaining a first-run completion of the census along with constructive criticism and evaluation of its meaning, content, length, etc.

Each question on the census requires one answer. It is requested that the census be completed as soon as possible and returned to SMC # 2882 with any comments or criticisms which you feel are applicable.

PROFESSIONAL PREFERENCE CENSUS

1. Indicate what you expect your annual income to be 15 years from now. ☐
   A) $20,000
   B) $25,000
   C) $30,000
   D) $40,000
   E) More than the above

2. Indicate the type of information upon which you would tend to place highest credibility. ☐
   A) Professional journals
   B) Colleagues
   C) Vendors and/or trade councils
   D) Personal knowledge and/or experience
   E) Independent research reports

3. At the present time if you had to place yourself in one of the following social classes, which would you choose? ☐
   A) Upper
   B) Lower-Upper
   C) Upper-Middle
   D) Middle
   E) Lower-Middle

4. Indicate which word, when placed in the following sentence, would most accurately describe you: I feel that I hear about new things _____ most of my colleagues. ☐
   A) Considerably before
   B) Sooner than
   C) At about the same time as
   D) Later than
   E) Sometime after

5. Indicate the number of technical, professional, and/or scientific society meetings which you attended last year. ☐
   A) 0-2
   B) 3-4
   C) 5-7
   D) 8-10
   E) More than the above

6. When you are on the job, do you most prefer work that is: ☐
   A) Concerned with accomplishing a specific task.
   B) Concerned with attempting to solve a challenging but not specifically assigned task.
   C) Concerned with accomplishing those tasks which I am individually responsible.
   D) Concerned with the efficient utilization of resources.
   E) None of the above.

7. In the past month how many times have you sought further information about an idea which you thought to be new and useful to your work? ☐
   A) 0-2
   B) 3-4
   C) 5-7
   D) 8-10
   E) More than the above

8. Indicate the frequency with which your colleagues came to you in the past month for work-related information and/or advice. ☐
   A) 1-3
   B) 4-7
   C) 8-12
   D) 13-18
   E) More than the above

9. Indicate the level within the social strata to which you would aspire to be 10 years from now. ☐
   A) Upper
   B) Lower-Upper
   C) Upper-Middle
   D) Middle
   E) Lower-Middle

10. Indicate the dollar budget for which you have control at your present billet. ☐
   A) 0-500,000
   B) 500,001 to 1,000,000
   C) 1,000,001 to 5,000,000
   D) 5,000,001 to 10,000,000
   E) More than the above

11. In your experience, which of the following do you tend to rely most heavily upon as a source of technical information? ☐
   A) Professional, technical, and trade journals.
   B) Representatives of, or documentation generated by suppliers of potential suppliers.
   C) Ideas which were previously used by yourself in similar situations.
   D) Selected members of your staff.
   E) Sources which do not fall into any of the above categories.

12. Indicate what you consider your primary reference group to be: ☐
   A) Community associates
   B) Officers within your specialized field
   C) Personal friends within the Navy
   D) Work-related colleagues
   E) People other than those listed above

13. Indicate the total number of journals, magazines, and newspapers which you regularly read: ☐
   A) 1-2
   B) 3-4
   C) 5-7
   D) 8-10
   E) More than the above

14. Indicate which of the following best characterizes your approach to an innovative idea: ☐
   A) Venturesome-very eager to try new ideas.
   B) Discreet use of new ideas.
   C) Deliberate for sometime before adopting a new idea.
   D) Skeptical and cautious.
   E) Prefer to only use proven ideas.

15. During the last month, indicate the relative frequency with which you recommended a specific journal and/or magazine article to a colleague which dealt with a work-related topic. ☐
   A) 1-2
   B) 3-4
   C) 5-7
   D) 8-10
   E) More than the above

16. How many miles do you travel a year independent of any permanent change of station? ☐
   A) 0-5,000
   B) 5,001 to 15,000
   C) 15,001 to 30,000
   D) 30,001 to 50,000
   E) More than the above

17. Mr. E, a civil engineer, who is married and has three children recently decided to perform some major improvements upon his house (cost approximately $1,000). Mr. E. realized that the improvements were not urgently required but would make life at home more comfortable for the E family. Consequently, Mr. E. was faced with a decision as to how he should finance the home improvements because such seemed to be the sole determinant as to when the E's could utilize these improvements. Indicate which of the following financial decisions you would advise Mr. E. to make for his home improvements. ☐

A) Borrow the necessary money immediately at 18% annual interest.
B) Save for 6 months and borrow the remainder at 10% annual interest.
C) Save for one year and borrow the remaining at 7% annual interest.
D) Save for two years and pay cash for the improvements.

18. Indicate which one of the following does <u>not</u> describe a new product or new process. ☐

A) biodegradeable plastics
B) ammi lift dock
C) recycled plastic as concrete aggregate
D) xeroradiography
E) laser anodizing

19. Mr. A, an electrical engineer, who is married and has one child, has been working for a large electronics corporation since graduation from college five years ago. He is assured of a lifetime job with a modest, though adequate, salary, and liberal pension benefits upon retirement. On the other hand, it is very unlikely that his salary will increase much before he retires. While attending a convention, Mr. A is offered a job with a small, newly founded company which has a highly uncertain future. The new job would pay more to start and would offer the possibility of a share in the ownership if the company survived the competition of the larger firms. ☐

Imagine that you are advising Mr. A. Listed below are several probabilities or odds of the new company's proving financially sound.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A to take the new job.

A) The chances are 1 in 10 that the company will prove financially sound.
B) " " " 3 in 10 " " " " " " " .
C) " " " 5 in 10 " " " " " " " .
D) " " " 7 in 10 " " " " " " " .
E) " " " 9 in 10 " " " " " " " .

20. Biographical data.

A) Please indicate the type of organization you are working in at the present time.

_____

B) Please indicate the title of your billet and present rank.

_____

C) How many years have you held your present rank? _____

D) How many years did you hold your previous rank? _____

E) How many years of post-high school education have you attended? _____

Appendix Two

Following the administering of the PPC, selected respondents were interviewed. The Oral Linker Census shown here was used as the guide. No notes were taken during the oral interview, however the OLC was used in order to be sure that all questions were asked and in the proper order.

The OLC was used as a validity test device to check the accuracy of the PPC in terms of accomplishing the stated objective.

Appendix Two

ORAL LINKER CENSUS

Name: _____ L1; PL; NM; PS; ST

Designator: _____ Rank _____

Previous Assignment: _____ Score _____

Note: All questions are related to the most recent tour of duty prior to DUINS at the Naval Postgraduate School.

1. Please think of a work-related new* idea which you thought about implementing at your last duty station.

   Were any attempts made to bring this idea into fruition? Yes _____ No ____

   If "yes" describe the action taken: _____

   If "no" explain why: _____

   If "yes" did you encounter any organizational barriers or individual objections to the idea? Yes _____ No _____.
   Explain: _____

Score: 1 2 3 4 5 6 7 8 9 10

* "New" means that it is new as perceived by the individual. It matters little whether or not an idea is objectively new as measured by the amount of time elapsed since its first use or discovery.

2. Please think of the most recent work-related project which you completed at your last duty station.

Date project initiated: ----------

Date project completed: ----------

If the completion time was excessive explain: ----------

Please identify the most important source of information: ----------

---

Who supplied the initial idea for the project? ----------

Who recognized the need for such a project? ----------

Was the project specifically assigned to you? Yes _____ No _____

If "no" explain: ----------

Were there any changes between the initial idea and the idea which was actually implemented? Yes _____ No _____

If "yes" who supplied the majority of the changes? ----------

Comments: ----------

Score: 1 2 3 4 5 6 7 8 9 10

3. Can you recall a work-related project which you completed at your last duty station for which you supplied the original idea? Yes ____ No ____

If yes, what was the project? ----------

Where did you get the idea: ----------

Were any barriers and/or objections encountered which deterred immediate acceptance? Yes ____ No ____

If "yes", explain: ----------

Where did you get the majority of information from idea inception to project completion? ----------

---

Did the information sources change as the project moved from initial idea to completed project? Yes ____ No ____

If "yes", explain: _____

_____

_____

_____

Score: 1 2 3 4 5 6 7 8 9 10

4. In the context of your last duty station, please think of the most recent instance in which an item of information which you received from a source, other than someone in your immediate circle of colleagues, proved to be useful in your work.

What was the source of the information?_____

Before receiving this information had you recognized a need for such information? Yes ____ No ____

If "yes", what was the length of time between recognition of the need and receipt of the information? _____

If the time duration was excessive, explain: _____

_____

_____

If "yes" explain how you recognized the need for the information (I specifically searched for the information; someone gave this information, a lead to it, or the material containing the information, on [1] the basis of having been previously told of my interests in such information, or [2] a voluntary basis; I ran across it or a lead to it while searching specifically for some other item of information; I found it while reviewing current literature; I went directly to a person or document from which (a) I expected to find the information, or (b) I expected to find a lead to the information):_____

_____

_____

_____

_____

Please indicate the three (3) major sources of information which you regularly use for work related innovations and/or ideas: _____

_____

_____

Of the above which do you use most frequently?_____

Why? _____

_____

_____

_____

Score: 1 2 3 4 5 6 7 8 9 10

5. What work-related conventions did you attend in the last six months of your last duty station? ---

---

Of these conventions, which did you specifically request to attend? ---

---

Are there any conventions and/or technical, professional, or scientific society meetings which you requested to attend but were unable to do so for one reason or another? Yes ____ No ____

Explain: ---

Score: 1 2 3 4 5 6 7 8 9 10

6. Do you consider that you have a primary reference group (group of people to whom you primarily relate)?

Explain: ---

Indicate and explain the level of social participation which you maintain within this primary reference group: ---

---

Score: 1 2 3 4 5 6 7 8 9 10

7. General Comments:

Appendix Three

Appendix contains four items:

1. Cover letter for final PPC mailing.
2. Final PPC also referred to as Revised PPC or RPPC.
3. Scoring data for RPPC.

Items 1 and 2 are self explained.

Item 3 is a copy of the RPPC on which the scoring code has been added.

Close inspection of question 1 shows that a = 1, b = 2, c = 3, d = 4 and c = 5.

In the case of question 2 it is shown that a = 5, b = 4, c = 3, d = 2 and c = 1.

Not all question coding is in ascending or descending order. For example, question 6 is as follows: a = 2, b = 5, c = 3, d = 4 and e = 1.

Appendix Three

NC4(55Jo)/bsg
10 April 1972

MEMORANDUM

From: Dr. J. A. Jolly, Associate Professor (Code 55Jo)
Operations Research & Administrative Sciences Dept.

To:

Subj: Research Assistance; request for

Encl: (1) Professional Preference Census

The enclosed Professional Preference Census is being distributed to you (certain officers within the CEC) in order to obtain data for an independent research project which is funded by NAVFACENGCOM.

The accuracy and validity of the research is dependent on questionnaire answers that are free of biasing forces. For this reason explanatory information concerning the research is not included in this Memorandum.

Each question requires that you circle one answer only. Please answer all of the questions in the Census.

It is requested that enclosure (1) be completed and returned at your earliest convenience.

Thank you for your assistance and cooperation.

James A. Jolly

PROFESSIONAL PREFERENCE CENSUS

1. Assuming that you were to make the Navy a career, what would be the highest rank to which you would aspire? ☐
   a) Lieutenant Commander
   b) Commander
   c) Captain
   d) Rear Admiral
   e) Admiral

2. Indicate the type of information upon which you would place highest credibility. ☐
   a) Personal knowledge
   b) Associated staff
   c) Vendors and/or trade councils
   d) Literature - journals, books, etc.
   e) Analysis and experimentation

3. Indicate which combination of words, when placed in the following sentence, would most accurately describe you: I feel that I near about new work-related developments in my professional area _____ most of my colleagues. ☐
   a) considerably before
   b) sooner than
   c) at about the same time as
   d) later than
   e) sometime after

4. In the past year, how many nonroutine, work-related projects have been completed for which you supplied the original idea? ☐
   a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above.

5. Indicate the number of technical and/or scientific society meetings and/or conventions which you attended last year which involved personnel other than your immediate circle of colleagues. ☐
   a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above.

6. When you are on the job, do you most prefer work that is: ☐
   a) concerned with accomplishing a specific task
   b) concerned with attempting to solve a challenging but not specifically assigned task
   c) concerned with accomplishing those tasks for which I am individually responsible
   d) concerned with the efficient utilization of resources
   e) None of the above.

7. In the past month how many times have you sought further information about a new idea or ideas which you thought to be useful to your work? ☐
   a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above.

8. Mr. E., a civil engineer, who is married and has three children recently decided to perform some major improvements upon his house (cost approximately $1,000). Mr. E. realized that the improvements were not urgently required but would make life at home more comfortable for the E. family. Consequently, Mr. E. was faced with a decision as to how he should finance the home improvements because such seemed to be the sole determinant as to when the E's could utilize these improvements. Indicate which of the following financial decisions you would advise Mr. E. to make for his home improvements. ☐

a) Borrow the necessary money immediately at 18% annual interest.
b) Save for 6 months and borrow the remainder at 10% annual interest.
c) Save for one year & borrow the remaining at 7% annual interest.
d) Save for two years & pay cash for the improvements if present interest rates remain the same.
e) Make no improvements.

9. Indicate the frequency with which your subordinates, peers, and/or superiors came to you in the past month for work-related information and/or advice which was not a function of your formal position. ☐

a) 1-3 b) 4-9 c) 10-15 d) 16-20 e) More than the above.

10. Indicate the total number of journals, magazines, and newspapers which you regularly read: ☐

a) 1-2 b) 3-4 c) 5-6 d) 7-8 e) More than the above.

11. Indicate the number of technical, scientific, and/or professional societies to which you hold current membership. ☐

a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above.

12. Indicate the level within the social strata to which you would aspire to be 10 years from now. ☐

a) Upper
b) Lower-Upper
c) Upper-Middle
d) Middle
e) Lower-Middle

13. Mr. C., a civil engineer, who is employed by a medium sized construction firm recently learned of a new building material which is used extensively in Europe but never adopted in the United States. The building material appears to have several advantages in terms of substantial cost reduction, superior insulation qualities, and relative ease of construction as compared to its counter part in the United States. ☐

After a thorough investigation, Mr. C. obtained extensive and reliable information on the characteristics, costs, and advantages of the new material. Further, his company could easily obtain exclusive manufacturing rights for use in the United States.

Imagine that you are Mr. C. Indicate which of the following would best describe your approach to the building material.

a) Recommend that the new idea be utilized in the firm's next major building project so as to take advantage of the substantial cost savings.
b) Recommend that the building material be used in one of the firm's small, local building projects so as to test its acceptance.
c) Recommend that the firm construct a non-commercial prototype.
d) Recommend that the firm engage the services of an independent consultant firm so as to verify the information obtained and to test market acceptance.
e) Recommend that the firm wait until the building material has received considerable commercial application in the United States.

14. In your experience, which of the following do you tend to rely <u>most</u> heavily upon as a source of technical information for work-related projects and/or problems? ☐

a) Literature-books, government manuals, and professional trade and technical journals.
b) Vendors-representatives of, or documentation generated by suppliers or potential suppliers.
c) Personal experience - ideas which were previously used by yourself in similar situations and recalled directly from memory.
d) Staff - selected members of your staff who are not assigned directly to the project being considered.
e) External sources - sources which do not fall into any of the above categories.

15. Indicate the group of people to whom you primarily relate. ☐

a) Officers within your specialized field.
b) Work-related colleagues (both military and civilian).
c) Community associates.
d) I have a primary reference group but it is people other than those listed above.
e) I do <u>not</u> have a primary reference group.

16. During the last month, indicate the relative frequency with which you recommended a specific item of interest, e.g., journal article, research report, or a lead to either, to a colleague which dealt with a work-related topic. ☐

a) 0 b) 1-2 c) 3-4 d) 5-6 e) More than the above.

17. Mr. A., a middle management executive, who is married and has one child, has been working for a corporation since graduation from college five years ago. He is assured of a lifetime job with a modest, though adequate, salary, and liberal pension benefits upon retirement. On the other hand, it is very unlikely that his salary will increase much before he retires. While attending a convention, Mr. A. is offered a job with a small, newly founded company which has a highly uncertain future. The new job would pay more to start and would offer the possibility of a share in the ownership if the company survived the competition of the larger firms. ☐

Imagine that you are advising Mr. A. Listed below are several probabilities or odds of the new company's proving financially sound.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A. to take the new job.

a) The chances are 1 in 10 that the company will prove financially sound.
b) The chances are 3 in 10 that the company will prove financially sound.
c) The chances are 5 in 10 that the company will prove financially sound.
d) The chances are 7 in 10 that the company will prove financially sound.
e) The chances are 9 in 10 that the company will prove financially sound.

18. Indicate which of the following best characterizes your approach to an innovative idea: ☐

a) Very eager to adopt new ideas.
b) Discreet use of new ideas.
c) Deliberate for sometime before adopting a new idea.
d) Skeptical & cautious about adopting a new idea.
e) Prefer to only use proven ideas.

19. Biographical data.

a) Please indicate the type of organization you are working in at the time.

_____

b) Please indicate the title of your billet and present rank.

_____

c) How many years have you held your present rank? _____
d) How many years did you hold your previous rank? _____

Scoring of Revised Professional Preference Census

PROFESSIONAL PREFERENCE CENSUS

1. Assuming that you were to make the Navy a career, what would be the highest rank to which you would aspire? ☐

1 a) Lieutenant Commander
2 b) Commander
3 c) Captain
4 d) Rear Admiral
5 e) Admiral

2. Indicate the type of information upon which you would place highest credibility. ☐

5 a) Personal knowledge
4 b) Associated staff
3 c) Vendors and/or trade councils
2 d) Literature - journals, books, etc.
1 e) Analysis and experimentation

3. Indicate which combination of words, when placed in the following sentence, would most accurately describe you: I feel that I hear about new work-related developments in my professional area _____ most of my colleagues. ☐

5 a) considerably before
4 b) sooner than
3 c) at about the same time as
2 d) later than
1 e) sometime after

4. In the past year, how many nonroutine, work-related projects have been completed for which you supplied the original idea? ☐

a) 0 (1) b) 1-2 (2) c) 3-4 (3) d) 5-6 (4) e) More than the above. (5)

5. Indicate the number of technical and/or scientific society meetings and/or conventions which you attended last year which involved personnel other than your immediate circle of colleagues. ☐

a) 0 (1) b) 1-2 (2) c) 3-4 (3) d) 5-6 (4) e) More than the above. (5)

6. When you are on the job, do you most prefer work that is: ☐

2 a) concerned with accomplishing a specific task
5 b) concerned with attempting to solve a challenging but not specifically assigned task
3 c) concerned with accomplishing those tasks for which I am individually responsible
4 d) concerned with the efficient utilization of resources
1 e) None of the above.

7. In the past month how many times have you sought further information about a new idea or ideas which you thought to be useful to your work? ☐

a) 0 (1) b) 1-2 (2) c) 3-4 (3) d) 5-6 (4) e) More than the above. (5)

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2 d) Save for two years & pay cash for the improvements if present interest rates remain the same.
1 e) Make no improvements.

9. Indicate the frequency with which your subordinates, peers, and/or superiors came to you in the past month for work-related information and/or advice which was not a function of your formal position. ☐

a) 1-3 (1) b) 4-9 (2) c) 10-15 (3) d) 16-20 (4) e) More than the above. (5)

10. Indicate the total number of journals, magazines, and newspapers which you regularly read: ☐

a) 1-2 (1) b) 3-4 (2) c) 5-6 (3) d) 7-8 (4) e) More than the above. (5)

11. Indicate the number of technical, scientific, and/or professional societies to which you hold current membership. ☐

a) 0 (1) b) 1-2 (2) c) 3-4 (3) d) 5-6 (4) e) More than the above. (5)

12. Indicate the level within the social strata to which you would aspire to be 10 years from now. ☐

5 a) Upper
4 b) Lower-Upper
3 c) Upper-Middle
2 d) Middle
1 e) Lower-Middle

13. Mr. C., a civil engineer, who is employed by a medium sized construction firm recently learned of a new building material which is used extensively in Europe but never adopted in the United States. The building material appears to have several advantages in terms of substantial cost reduction, superior insulation qualities, and relative ease of construction as compared to its counter part in the United States. ☐

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3 b) Vendors-representatives of, or documentation generated by suppliers or potential suppliers.
1 c) Personal experience - ideas which were previously used by yourself in similar situations and recalled directly from memory.
4 d) Staff - selected members of your staff who are not assigned directly to the project being considered.
5 e) External sources - sources which do not fall into any of the above categories.

15. Indicate the group of people to whom you primarily relate. ☐

1a) Officers within your specialized field.
2b) Work-related colleagues (both military and civilian).
3c) Community associates.
4d) I have a primary reference group but it is people other than those listed above.
5e) I do not have a primary reference group.

16. During the last month, indicate the relative frequency with which you recommended a specific item of interest, e.g., journal article, research report, or a lead to either, to a colleague which dealt with a work-related topic. ☐

a) 0 (1) b) 1-2 (2) c) 3-4 (3) d) 5-6 (4) e) More than the above. (5)

17. Mr. A., a middle management executive, who is married and has one child, has been working for a corporation since graduation from college five years ago. He is assured of a lifetime job with a modest, though adequate, salary, and liberal pension benefits upon retirement. On the other hand, it is very unlikely that his salary will increase much before he retires. While attending a convention, Mr. A. is offered a job with a small, newly founded company which has a highly uncertain future. The new job would pay more to start and would offer the possibility of a share in the ownership if the company survived the competition of the larger firms. ☐

Imagine that you are advising Mr. A. Listed below are several probabilities or odds of the new company's proving financially sound.

Please check the lowest probability that you would consider acceptable to make it worthwhile for Mr. A. to take the new job.

5 a) The chances are 1 in 10 that the company will prove financially sound.
4 b) The chances are 3 in 10 that the company will prove financially sound.
3 c) The chances are 5 in 10 that the company will prove financially sound.
2 d) The chances are 7 in 10 that the company will prove financially sound.
1 e) The chances are 9 in 10 that the company will prove financially sound.

18. Indicate which of the following best characterizes your approach to an innovative idea: ☐

5 a) Very eager to adopt new ideas.
4 b) Discreet use of new ideas.
3 c) Deliberate for sometime before adopting a new idea.
2 d) Skeptical & cautious about adopting a new idea.
1 e) Prefer to only use proven ideas.

19. Biographical data.

a) Please indicate the type of organization you are working in at the time.

b) Please indicate the title of your billet and present rank.

c) How many years have you held your present rank? 0 - 8, 9 = ≥ 9
d) How many years did you hold your previous rank? 0 - 8, 9 = ≥ 9

Code to 19a

PWO=1, OICC=2, ROICC=3, H(2or3)=4, DUIN=5, EFD=6, CB=7, Other=8.

Code to 19b

CWO=0, ENS=1, LTJG=2, LT=3, LCDR=4, CDR=5, CAPT=6, RADM=7.

Appendix Four

The Linker/Stabilizer Validity Census as shown in this appendix was used as the basis of the oral questions that were asked of the selected respondents.

No notes were taken at the time of the oral interview, but there was specific effort to fill in the LVC soon after the interview in order to record accurate data.

A comparison with the OLC, Appendix 2, will show that numerous changes were necessary and desirable.

Appendix Four

LINKER/STABILIZER VALIDITY CENSUS

Name: _____ L1; PL; EM; LM; PS; ST _____

Designator: _____ Rank: _____

Present Duty Assignment: _____ Length: _____

1. Can you recall a new* work-related idea which you have thought about implementing while at this duty station? Yes _____ No _____

   If YES, what was the idea? _____

   _____

   Where did you get the idea? _____

   _____

   Have any attempts been made to bring this idea to fruition? Yes _____ No _____

   If YES, describe the action taken: _____

   _____

   _____

   _____

   Describe any organizational barriers or individual objections to the idea and/or its implementation which you might have encountered: _____

   _____

   _____

   _____

   If NO, explain why: _____

   _____

   _____

   _____

   Can you recall the most important information source after idea generation? Yes _____ No _____

   If YES, identify and describe its role: _____

   _____

   _____

   Score: 1 2 3 4 5 6 7 8 9 10

* "New" means that it is new as perceived by the individual or organizational entity to which he is a member. It matters little whether or not an idea is objectively new as measured by the amount of time elapsed since its first use or discovery.

** The Score is based upon the interviewer's subjective evaluation of the degree to which the question indicates that the respondent possesses the characteristics of a linker (9, 10), potential linker (7, 8) member of the non-discriminating majority (5, 6), potential stabilizer (3, 4), or stabilizer (1, 2).

[Note: Skip question two depending on respondents answer to question number one.]

2. Can you recall the most recent instance in which you thought of a new work-related idea but were unable to implement it for one reason or another?

Yes _____ No _____

If YES, what was the idea?_____

Where did you get the idea?_____

_____

Why wasn't the idea implemented? _____

_____

_____

_____

How frequent do instances similar to the above occur? _____

Have you experienced similar obstacles in all of your billets?

Yes _____ No _____

Explain: _____

_____

_____

_____

Are the barriers to implementation always the same? Yes ____ No ____

Explain: _____

_____

_____

_____

Score: 1 2 3 4 5 6 7 8 9 10

3. Can you recall the most recent work-related project which you have completed while at this duty station?

Yes _____ No _____

If YES, what was the project? _____

_____

Who supplied the initial idea for the project? _____

Who recognized the need for such a project? _____

Was the project specifically assigned to you? Yes _____ No _____

If NO, explain: _____

_____

_____

_____

Were there any changes between the initial idea and the idea which was actually implemented?

Yes _____ No _____

If YES who supplied the majority of the changes? _____

Comments: _____

_____

_____

Please identify your most important sources of information with respect to this project: _____

_____

_____

Did these information sources change as the project progressed?

Yes _____ No _____

Identify and explain: _____

_____

_____

_____

Score: 1 2 3 4 5 6 7 8 9 10

[Note: Skip question four if the response to question number three is negative.]

4. Aside from the above project, can you recall a work-related project which you have completed while at this duty station for which you supplied the original idea?

Yes _____ No _____

If YES, what was the project? _____

Where did you get the idea: _____

_____

Were any barriers and/or objections encountered which deterred immediate acceptance?

Yes _____ No _____

If YES, explain: _____

_____

_____

_____

_____

Where did you get the majority of information after idea inception?_____

_____

_____

_____

_____

_____

_____

Did the information sources change as the project moved from initial idea to completed project?

Yes _____ No _____

Identify and explain: _____

_____

_____

_____

_____

Score: 1 2 3 4 5 6 7 8 9 10

5. Can you recall the most recent instance in which a subordinate, superior, or peer came to you with a new work-related idea? Yes _____ No _____

If YES, what was the idea?_____
_____

If YES, was the person's coming to you required by his formal relationship to you? Yes _____ No _____

If YES, explain the formal relationship which exists: _____
_____
_____

If NO, explain why you feel this person came to you with this idea: _____
_____
_____

Explain what action hwas followed this person coming to you with respect to his new idea: _____
_____
_____
_____
_____

How frequent do instances similar to the above occur? _____

Explain: _____
_____
_____

Score: 1 2 3 4 5 6 7 8 9 10

6. In the context of your present duty station, please think of the most recent instance in which an item of information which you received from a source, other than someone in your immediate circle of colleagues, proved to be useful in your work.

What was the source of the information? _____

Before receiving this information had you recognized a need for such information?

Yes _____ No _____

If YES, what was the length of time between recognition of the need and receipt of the information? _____

If the time duration was excessive, explain: _____

_____

_____

If YES, explain how you recognized the need for the information (I specifically searched for the information; someone gave this information, a lead to it, or the material containing the information, on [1] the basis of having been previously told of my interests in such information, or [2] a voluntary basis; I ran across it or a lead to it while reviewing current literature; I went directly to a person or document from which (a) I expected to find the information, or (b) I expected to find a lead to the information): _____

_____

_____

_____

_____

_____

Please indicate the three (3) major sources of information which you find most helpful in your work: _____

_____

_____

Of the above which do you use most frequently? _____

Why? _____

_____

_____

_____

Score: 1 2 3 4 5 6 7 8 9 10

7. What work-related conventions* have you attended in the past year?

Of these conventions, which did you specifically request to attend?

Are there any conventions and/or technical, professional, or scientific society meetings which you requested to attend but were unable to do so for one reason or another?

Yes _____ No _____

Explain: ---

Score: 1 2 3 4 5 6 7 8 9 10

8. Do you consider that you have a group of people to whom you primarily relate?

Yes _____ No _____

Explain: ---

Indicate and explain the level of social participation which you maintain within this primary reference group: ---
---

Score: 1 2 3 4 5 6 7 8 9 10

* Conventions is defined very broadly to include technical and/or scientific society meetings and/or conventions which involved personnel other than your immediate circle of colleagues.

9. Can you recall the most recent new work-related development or innovation in your professional area that you have heard or read about? Yes ____ No ____

If YES what is the development? _____

How long has it been since you first heard or read about this development?

_____

Where did you first hear or read about this development? _____

_____

What are other sources from which you frequently hear or read about new work-related developments in your professional area? _____

_____

_____

Do you feel that the majority of your colleagues in the CEC are aware of this development?

Yes _____ No _____

Explain: _____

_____

_____

_____

On the average, when do you feel that you hear and/or read about new work-related developments in your professional area with respect to your colleagues in the CEC? _____

What leads you to this conclusion? _____

_____

_____

_____

Score: 1 2 3 4 5 6 7 8 9 10

10. Can you recall the most recent instance in which you actively sought information about a new idea or ideas which you thought to be useful to your work?

Yes _____ No _____

If YES with what was the information concerned? _____

To whom or what was the inquiry directed? _____

How frequently does the above occur? _____

Explain: _____

Score: 1 2 3 4 5 6 7 8 9 10

11. Can you recall the most recent instance in which you recommended a specific item of interest, e.g., journal article, research report, or a lead to either, to a colleague which dealt with a work-related topic?

Yes _____ No _____

If YES what was the item of interest? _____

What prompted you to recommend this item of interest? _____

How frequently does the above occur? _____

Explain: _____

Score: 1 2 3 4 5 6 7 8 9 10

12. General Comments:

Appendix Five

Standard Error of the Sample Mean

The standard error of the sample mean score* is determined using the following formula:

$$S_{\bar{x}} = \frac{S}{\sqrt{n}} \cdot \sqrt{\frac{N - n}{N - 1}}$$

where $S_{\bar{x}}$ = the standard error of the sample mean

s = the standard deviation of the sample

n = the number of elements in the sample

N = the population size

Substituting:

$$S_{\bar{x}} = \left(\frac{6.78}{\sqrt{1128}}\right)\left(\sqrt{\frac{1679 - 1128}{1679 - 1}}\right)$$

$$S_{\bar{x}} = (.202) \quad (.52)$$

$$= .105$$

Given the standard error of the sample mean, the magnitude of possible random error for a 99 per cent confidence level is computed using the following formula:

$$E = Z_{C.L.} S_{\bar{x}}$$

where

E = the magnitude of possible random error (measured in either direction from the sample mean)

Z = the Z - statistic

---

* Sample mean score is based upon the composite scores which exclude questions 14 and 15.

C.L. = the confidence level

Substituting:

$$E = Z_{.99}(.105)$$
$$= 2.58(.105)$$
$$= 0.27$$

Since the sample mean, $\bar{x}$, is 48.66, the probability is 0.99 that the mean score of a respondent will be in the following range:

$$\bar{x} - E < \mu < \bar{x} + E$$

Substituting

$$48.66 - .27 < \mu < 48.66 + .27$$
$$48.39 < \mu < 48.93$$

Appendix Six

Distribution of RPPC Scores

The histogram shows the distribution of individual scores after deletion of questions 14 and 15. The ordinate is scaled as the number of respondents obtaining a particular score and the abscissa is scaled in terms of the actual score received by the respondent. The mean score $\bar{x}$ is 48.66 and the standard deviation, S is 6.78.

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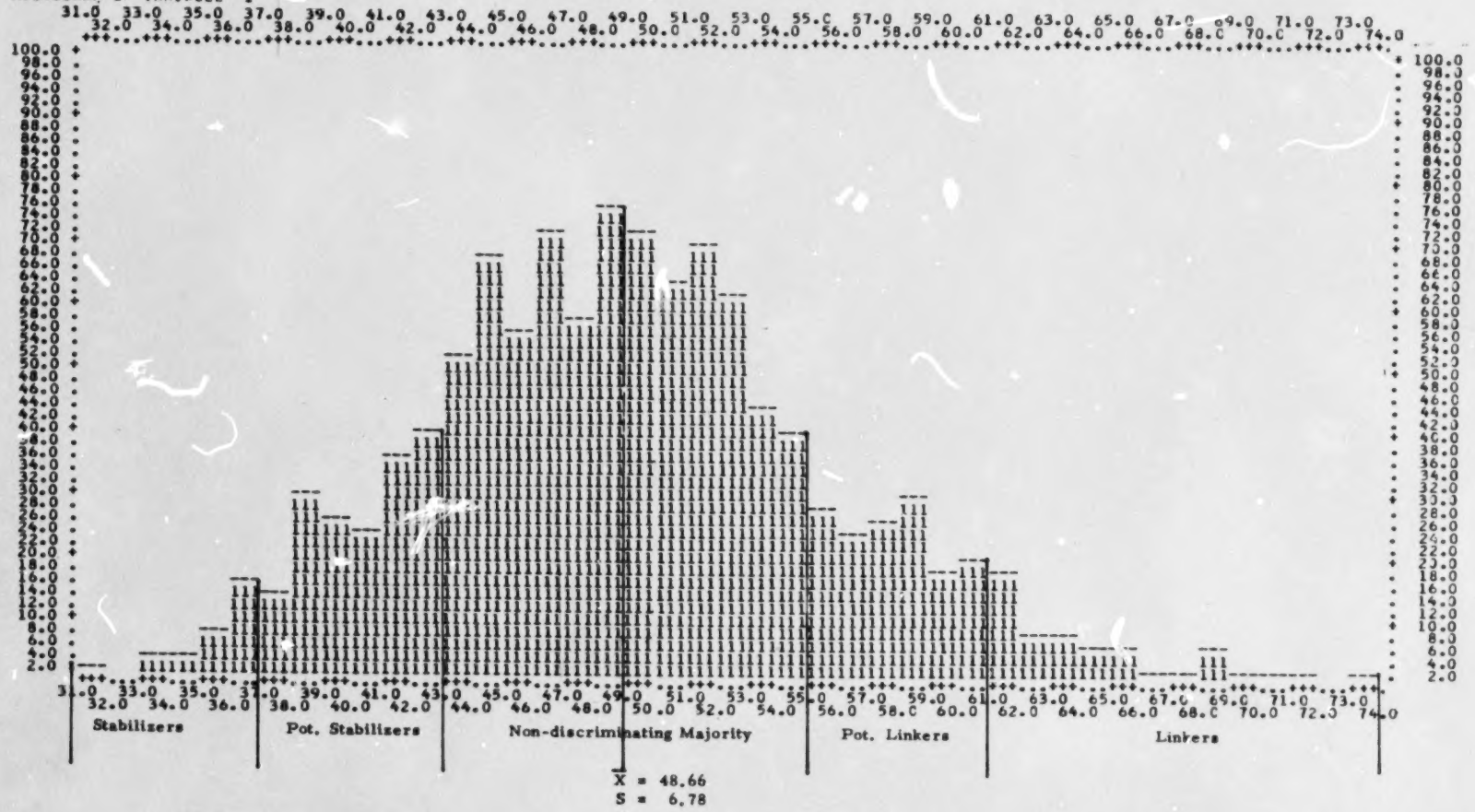
THE HISTORGRAM BELOW SHOWS THE DISTRIBUTION OF THE INDIVIDUAL SCORES
AFTER DELETION OF QUESTIONS NUMBER 14 & 15 .

HISTOGRAM OF VARIABLE 1



X = 48.66
S = 6.78

Appendix Seven

The Chi-Square Goodness-of-Fit Text

The Chi-Square technique was used to test the following null hypothesis: The sample distribution of the individual scores [see Appendix 6] agrees with the normal distribution. The technique tested whether the observed frequencies in the sample were sufficiently close to the expected (normal) frequencies to be likely to have occurred under the null hypothesis.

The null hypothesis was tested by

$$\chi^2_{k-3} = \sum_{i=1}^{k=19} \frac{(Oi-Ei)^2}{Ei}$$

Where Oi = observed number of cases in the i^{th} interval

Ei = expected number of cases in the i^{th} interval

This formula directs one to sum over 19 intervals the squared differences between each observed and expected frequency divided by the corresponding expected frequency.

The table of normal curve functions was used to set up the expected number of cases for the k = 19 grouping intervals. The degrees of freedom corresponded to the number of grouping intervals minus one less the number of parameters derived from the data and used in the fitting process. For the normal curve the observed and expected number of cases were made to agree with respect to two parameters, i.e., the mean and standard deviation. Hence the degrees of freedom = 19 - 1 - 2 = 16.

If the agreement between the observed and expected frequencies is close, the differences (Oi - Ei) will be small and consequently χ^2 will be small. If the divergence is large, however, the value of χ^2 will also be large. Generally speaking, the larger χ^2 is, the more likely it is that the observed distribution does not agree with the normal distribution.

A breakdown of the calculation of the χ^2 test statistic appears as part of this Appendix. The value of χ^2 was found to be 47.41. The rejection region is $\chi^2 \geq 26.3$ for a 5 percent level of significance. Hence, $\chi^2 = 47.41$ is significant and we reject the null hypothesis that the sample distribution agrees with the normal distribution.

Interval	Interval Range	Lower Z	Upper Z	Pu	Pl	ΔP		Oi	Oi-Ei	$(Oi-Ei)^2$	$\frac{(Oi-Ei)^2}{Ei}$
1	30.5-32.5	-2.68	-2.39	.0084	.0037	.0047	5.30	1	4.30	18.49	3.49
2	32.5-34.5	-2.39	-2.09	.0183	.0084	.0099	11.17	7	4.17	17.39	1.56
3	34.5-36.5	-2.09	-1.80	.0359	.0183	.0176	19.85	22	2.15	4.62	.23
4	36.5-38.5	-1.80	-1.50	.0668	.0359	.0309	34.86	42	7.14	50.98	1.46
5	38.5-40.5	-1.50	-1.21	.1131	.0668	.0463	52.23	49	3.23	10.43	.20
6	40.5-42.5	-1.21	- .91	.1814	.1131	.0683	77.04	75	2.04	4.16	.05
7	42.5-44.5	- .91	- .62	.2676	.1814	.0862	97.23	119	21.77	473.93	4.87
8	44.5-46.5	- .62	- .32	.3745	.2676	.1069	120.58	127	6.42	41.21	.34
9	46.5-48.5	- .32	- .03	.4880	.3745	.1135	128.03	133	4.97	24.70	.19
10	48.5-50.5	- .03	.27	.6064	.4880	.1184	133.56	137	3.44	11.83	.09
11	50.5-52.5	.27	.56	.7123	.6064	.1059	119.46	132	12.54	157.25	1.32
12	52.5-54.5	.56	.86	.8051	.7123	.0928	104.68	82	22.68	514.38	4.91
13	54.5-56.5	.86	1.15	.8749	.8051	.0698	78.73	52	26.73	714.49	9.08
14	56.5-58.5	1.15	1.45	.9265	.8749	.0516	58.20	55	3.20	10.24	.18
15	58.5-60.5	1.45	1.74	.9591	.9265	.0326	36.77	36	.77	.59	.02
16	60.5-62.5	1.74	2.04	.9793	.9591	.0202	22.79	25	2.21	4.88	.21
17	62.5-64.5	2.04	2.33	.9901	.9793	.0108	12.18	13	.82	.67	.06
18	64.5-66.5	2.33	2.63	.9957	.9901	.0056	6.32	8	1.68	2.82	.45
19	66.5-68.5	2.63	2.92	.9983	.9957	.0026	2.93	7	4.07	77.97	18.70
20	68.5-70.5	2.92	3.22	.9994	.9988	.0006	.68	4	3.32		
21	70.5-72.5	3.22	3.51	.9998	.9994	.0004	.45	1	.55		
22	72.5-74.5	3.51	3.81	.9999	.9998	.0001	.11	1	.89		

Appendix Eight

Histogram of Individual Question, Response of Linkers Only

Each of the 22 questions which are a part of the RPPC have been plotted as a histogram to show the distribution of answers. At the top of the histogram the question number is listed together with a very brief statement of the question. The complete text of the question may be found by referring to the RPPC which is Appendix 3. The respondent indicated an A through E choice for his answer to each question. For data processing the A through E answer has been translated into a numerical value of 1 through 5. The relationship of the letter to the number will vary depending upon the question. The coding of the questions is shown as Appendix 3. The coding was arranged so that a 1 would indicate a tendency toward a stabilizer while a 5 would indicate a tendency toward a linker.

As stated before, the individual question answer in itself does not identify a person operating as a linker, but rather the aggregate score for all questions.

When the histogram for question 1 of a Linker is compared to the histogram of question 1 of the stabilizer [Appendix 9]. It is possible to observe the relative difference in interests, self perception and/or performance that has been predicted by the research cited in the text of this report. This observed difference in the histograms is referred to as discrimination. As would be expected some of the questions show very good discrimination while others tend to show only small discrimination. Each question was statistically tested for this discriminate characteristic by using multiple discriminate analysis which is discussed in the section of the text titled, "RPPC Multiple Discriminate Analysis."

When studying the histograms it is useful to note that the Ordinate is the number of responses to a particular option of the question and the obscissa has among its values the cardinal numbers 1, 2, 3, 4 and 5 which are related to the code shown above the Histogram.

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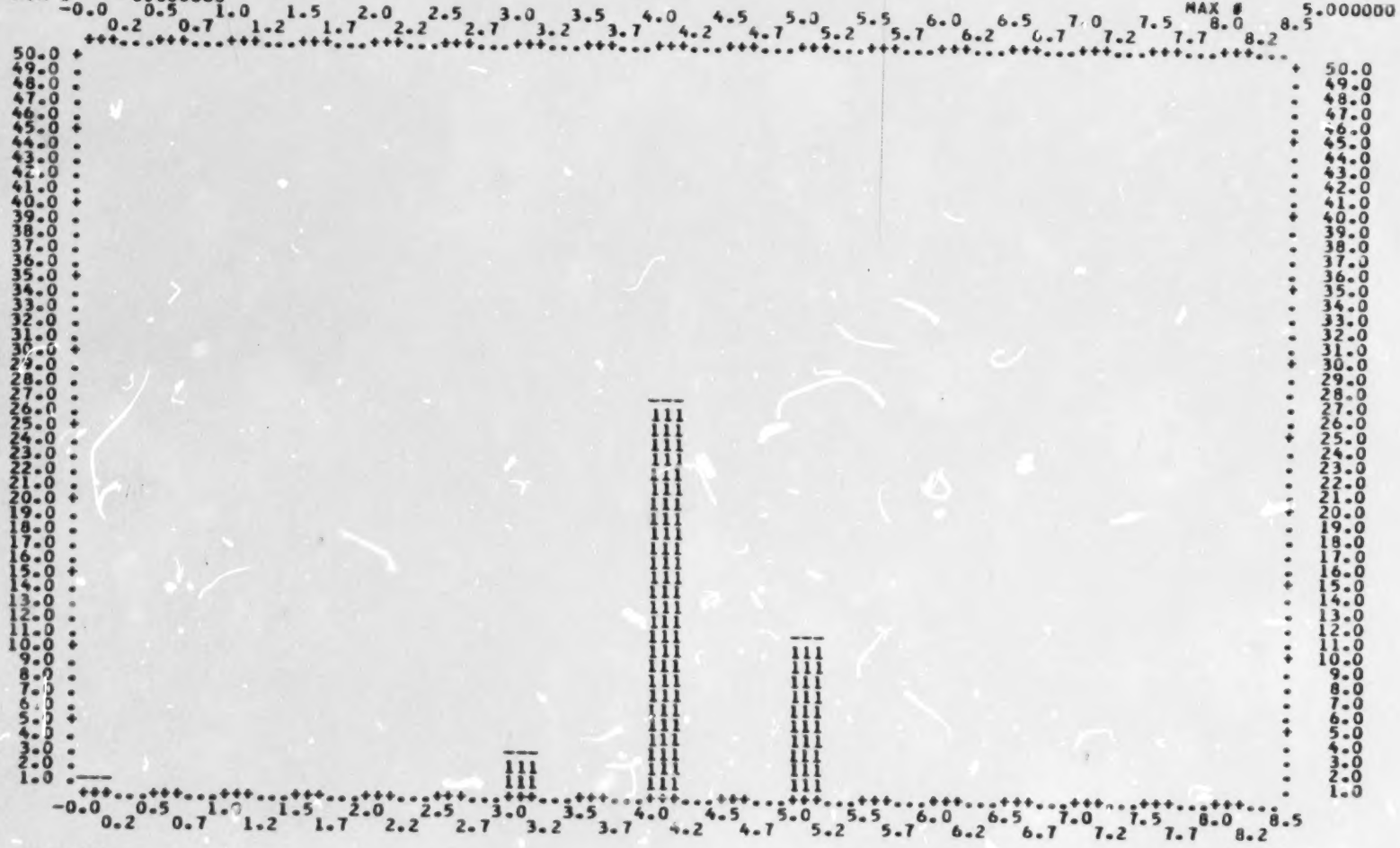
QUESTION 1: HIGHEST RANK TO WHICH YOU WOULD ASPIRE
1=LCRD, 2=CDR, 3=CAPT, 4=RADM, 5=ADM

HISTOGRAM OF VARIABLE 1

MIN # -0.000000 MAX # 5.000000



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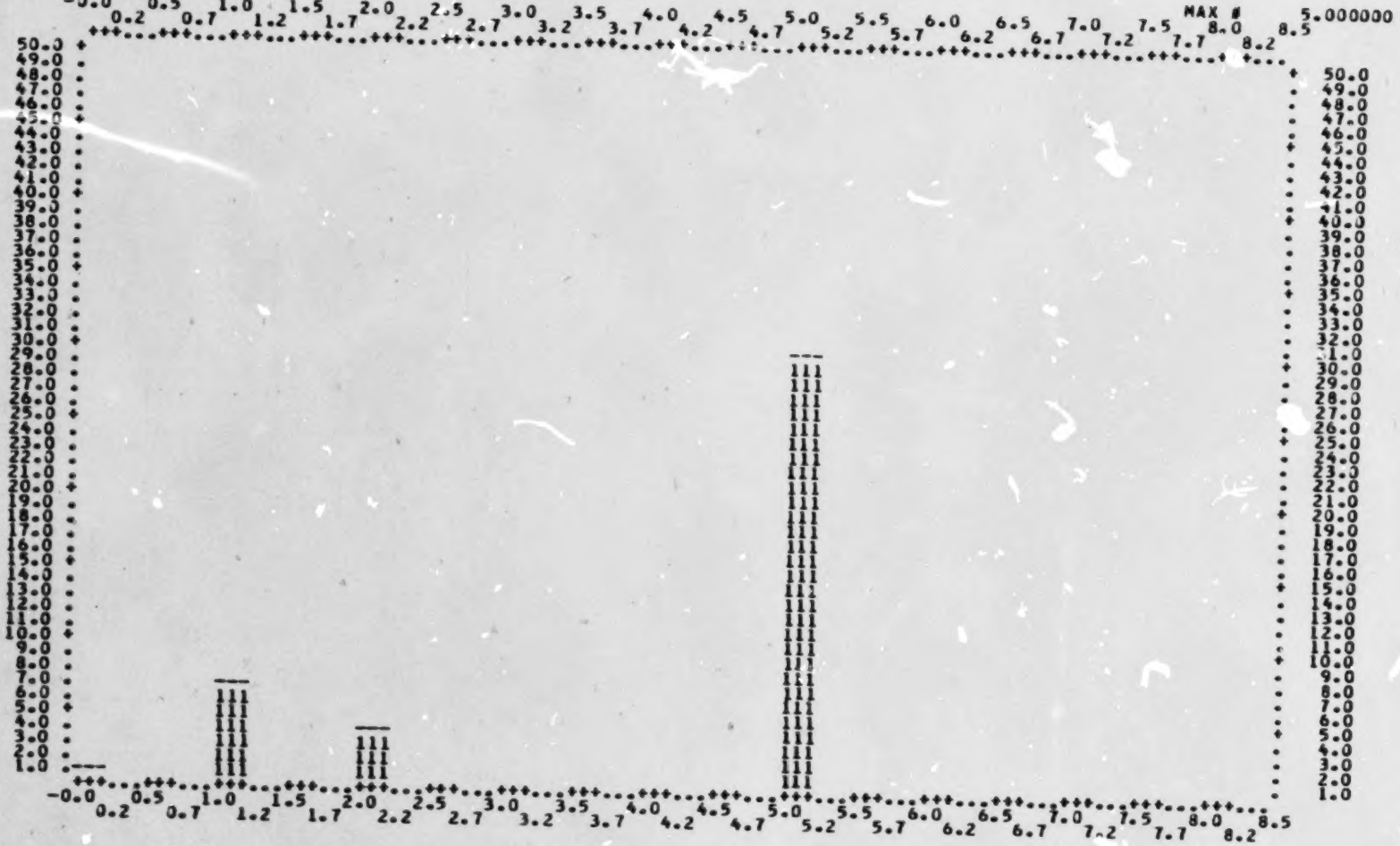
QUESTION 2: INFORMATION ON WHICH YOU WOULD PLACE HIGHEST CREDIBILTY
1=ANAL & EXPER, 2=LITERATURE, 3=VENDORS, 4=STAFF, 5=PERSONAL KNOWLEDGE

HISTOGRAM OF VARIABLE 2

MIN # -0.000000 MAX # 5.000000



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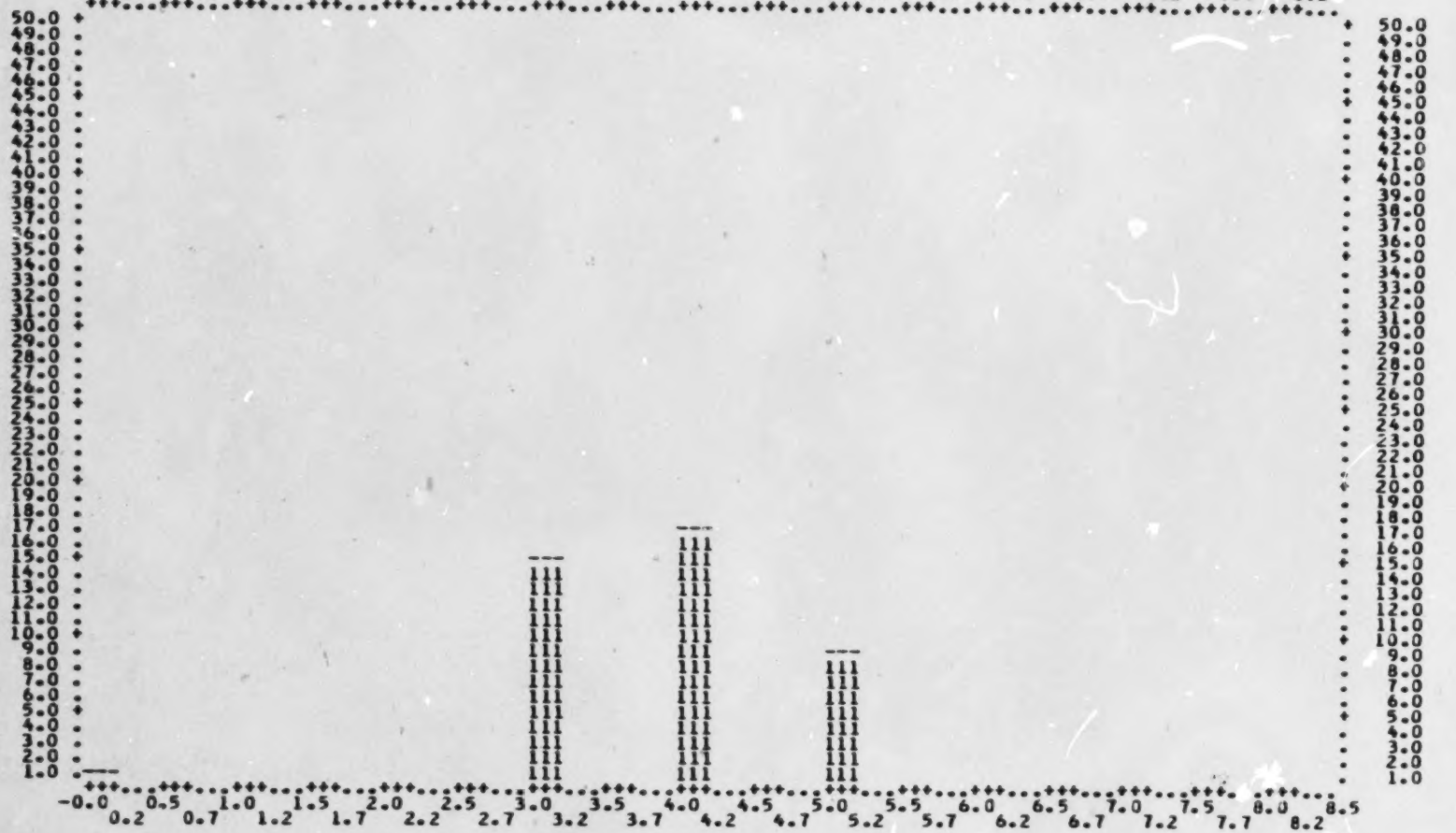
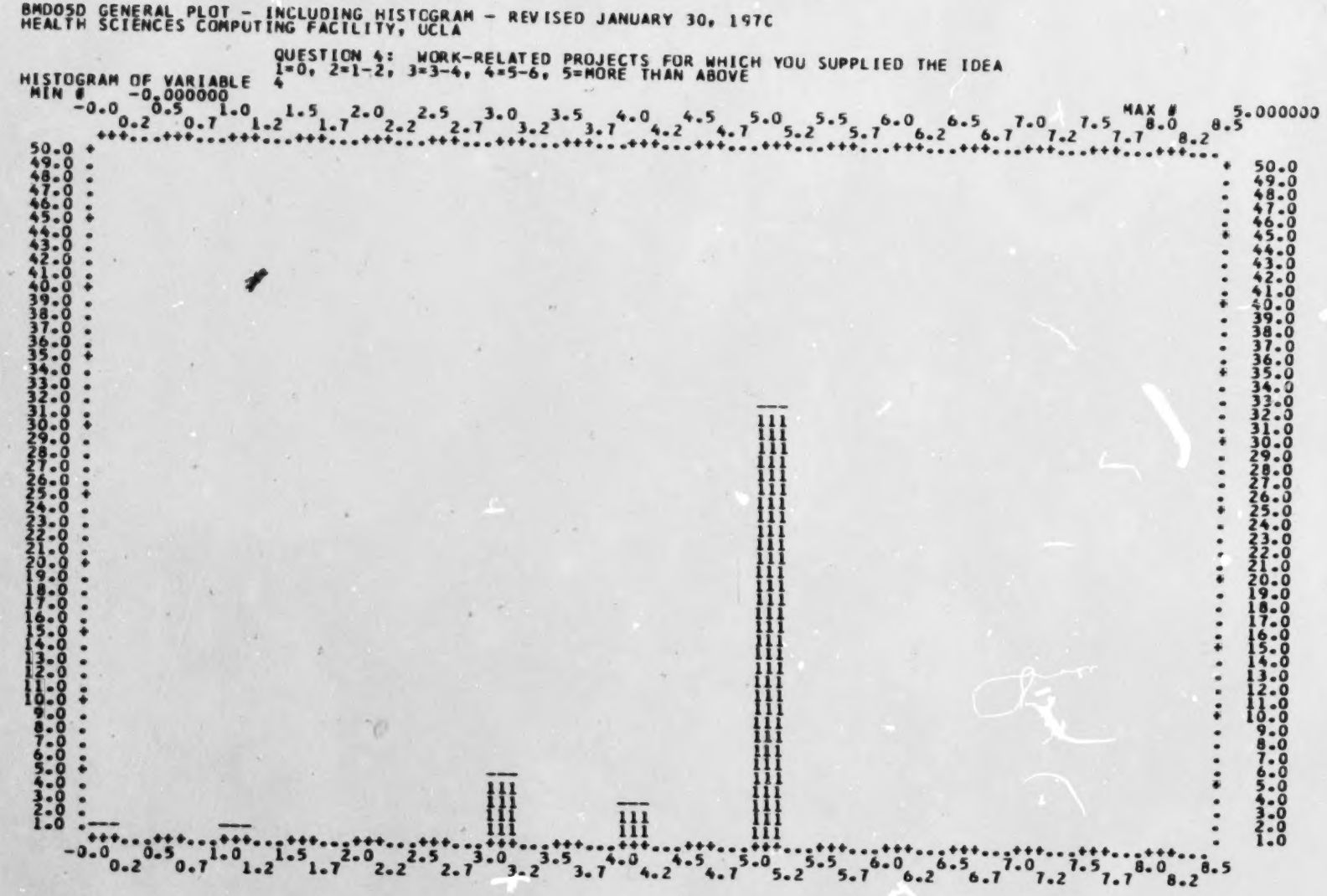
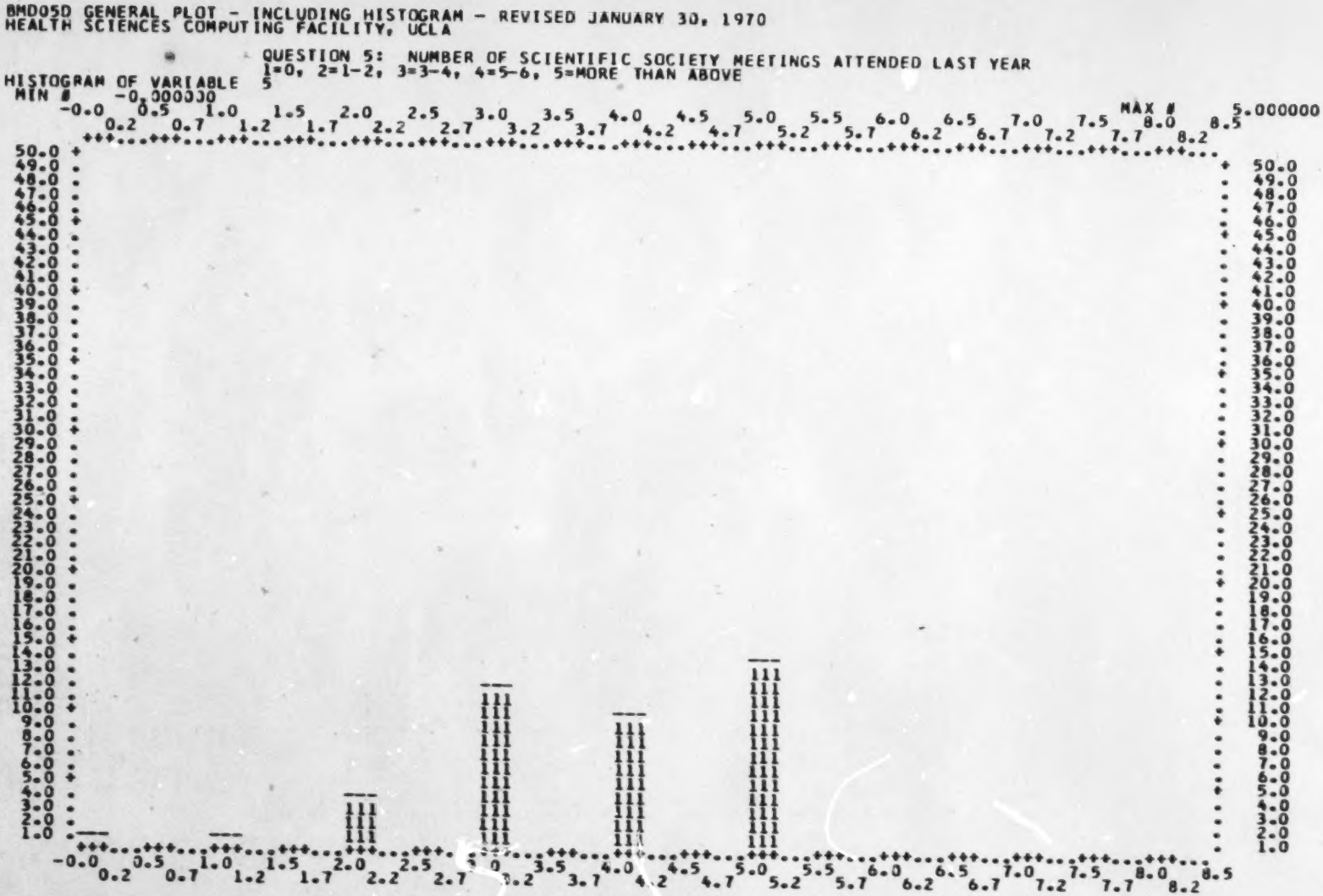
QUESTION 3: WHEN YOU HEAR ABOUT NEW WORK-RELATED DEVELOPMENTS
1=AFTER, 2=LATER THAN, 3=SAME TIME, 4=SOONER THAN, 5=CONSIDERABLY BEFORE

HISTOGRAM OF VARIABLE 3
MIN # -0.000000 MAX # 5.000000




BMDO5D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 197C
HEALTH SCIENCES COMPUTING FACILITY, UCLA
QUESTION 4: WORK-RELATED PROJECTS FOR WHICH YOU SUPPLIED THE IDEA
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE
HISTOGRAM OF VARIABLE 4
MIN # -0.000000
MAX # 5.000000


BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA
QUESTION 5: NUMBER OF SCIENTIFIC SOCIETY MEETINGS ATTENDED LAST YEAR
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE
HISTOGRAM OF VARIABLE 5
MIN # -0.000000
MAX # 5.000000

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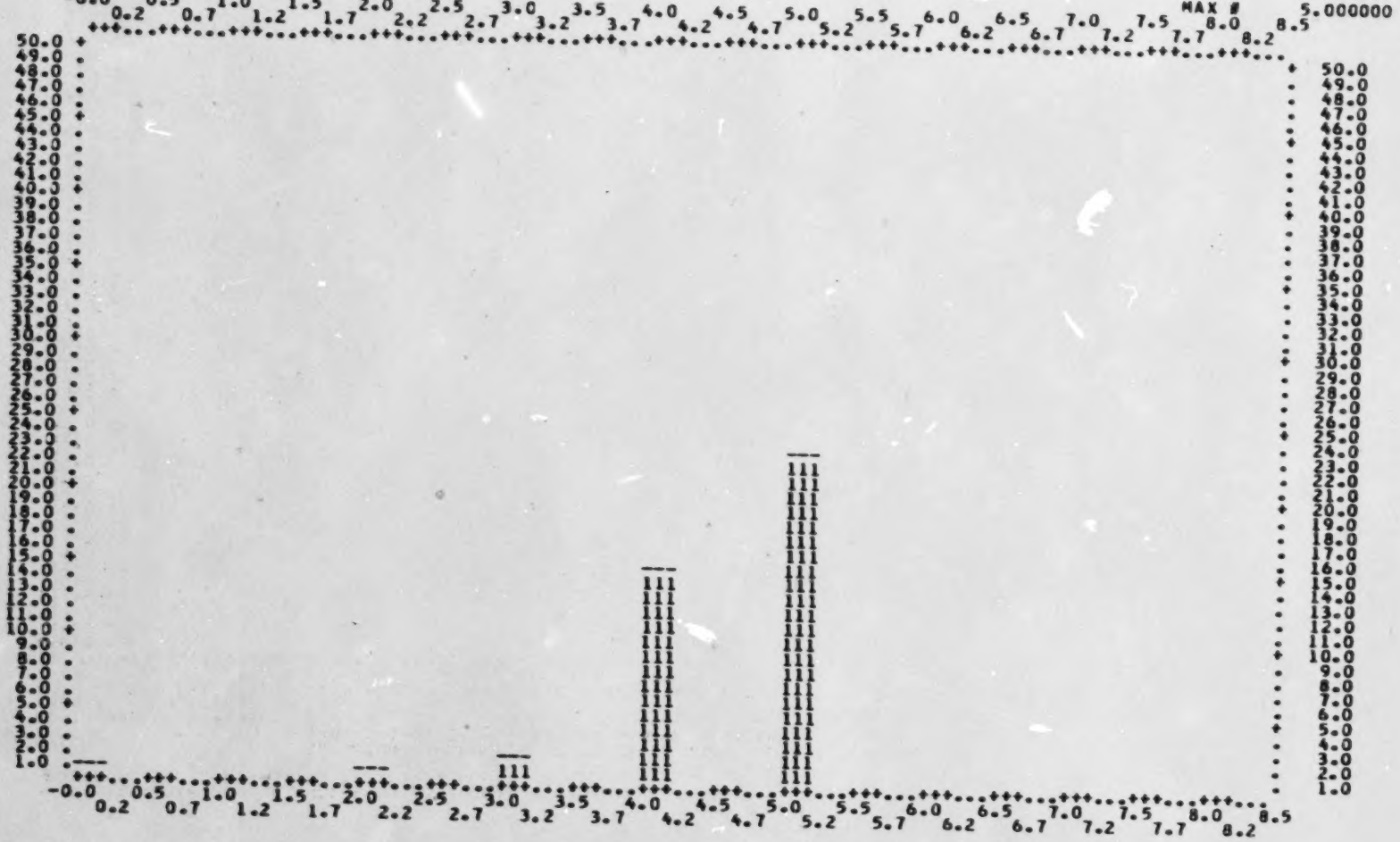
QUESTION 6: WORK YOU MOST PREFER WHEN ON THE JOB
1=NONE, 2=SPECIFIC TASK, 3=RESPONSIBLE, 4=RESOURCES, 5=CHALLENGING

HISTOGRAM OF VARIABLE 6

MIN # -0.000000 MAX # 5.000000



BMDOSD GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
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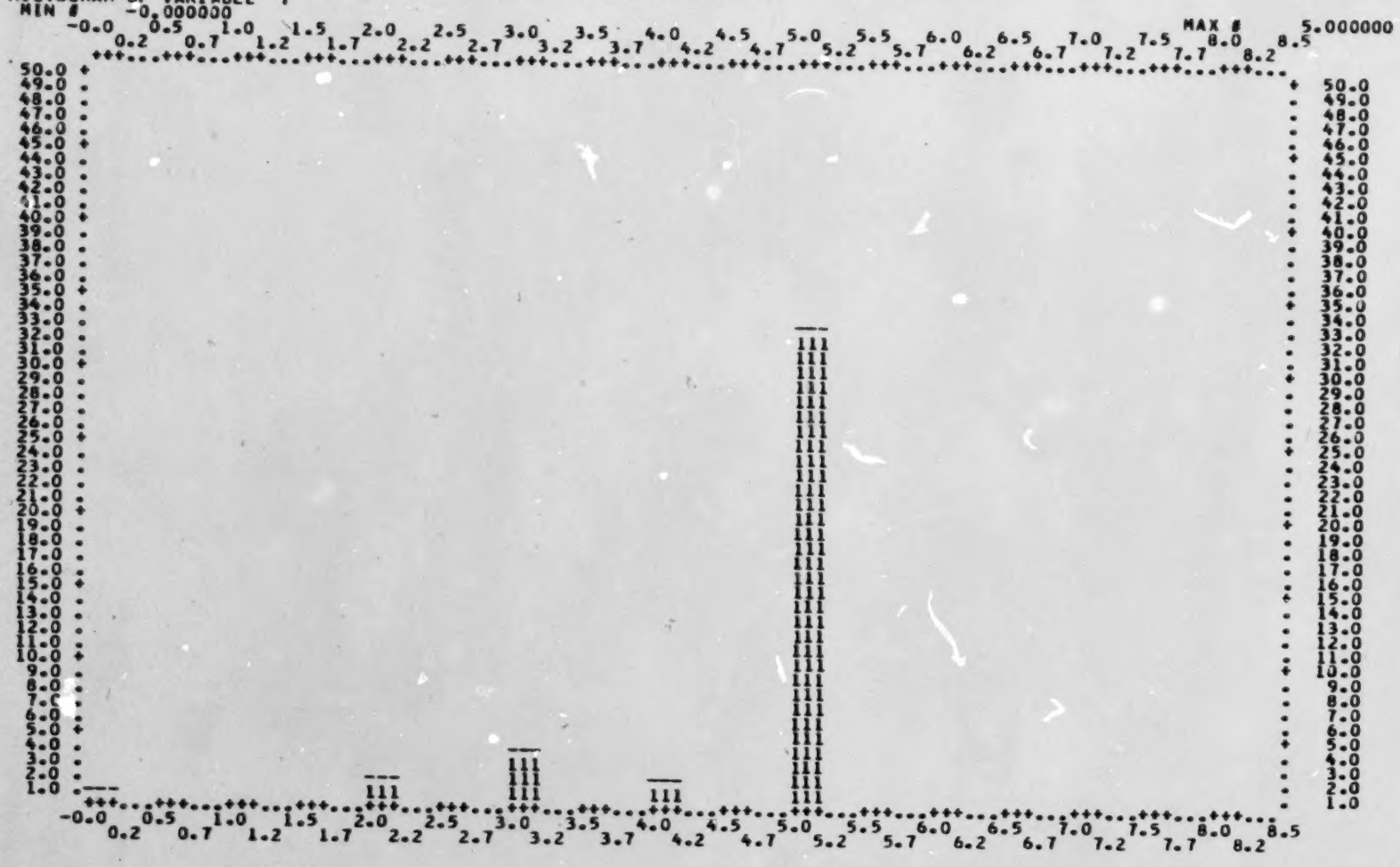
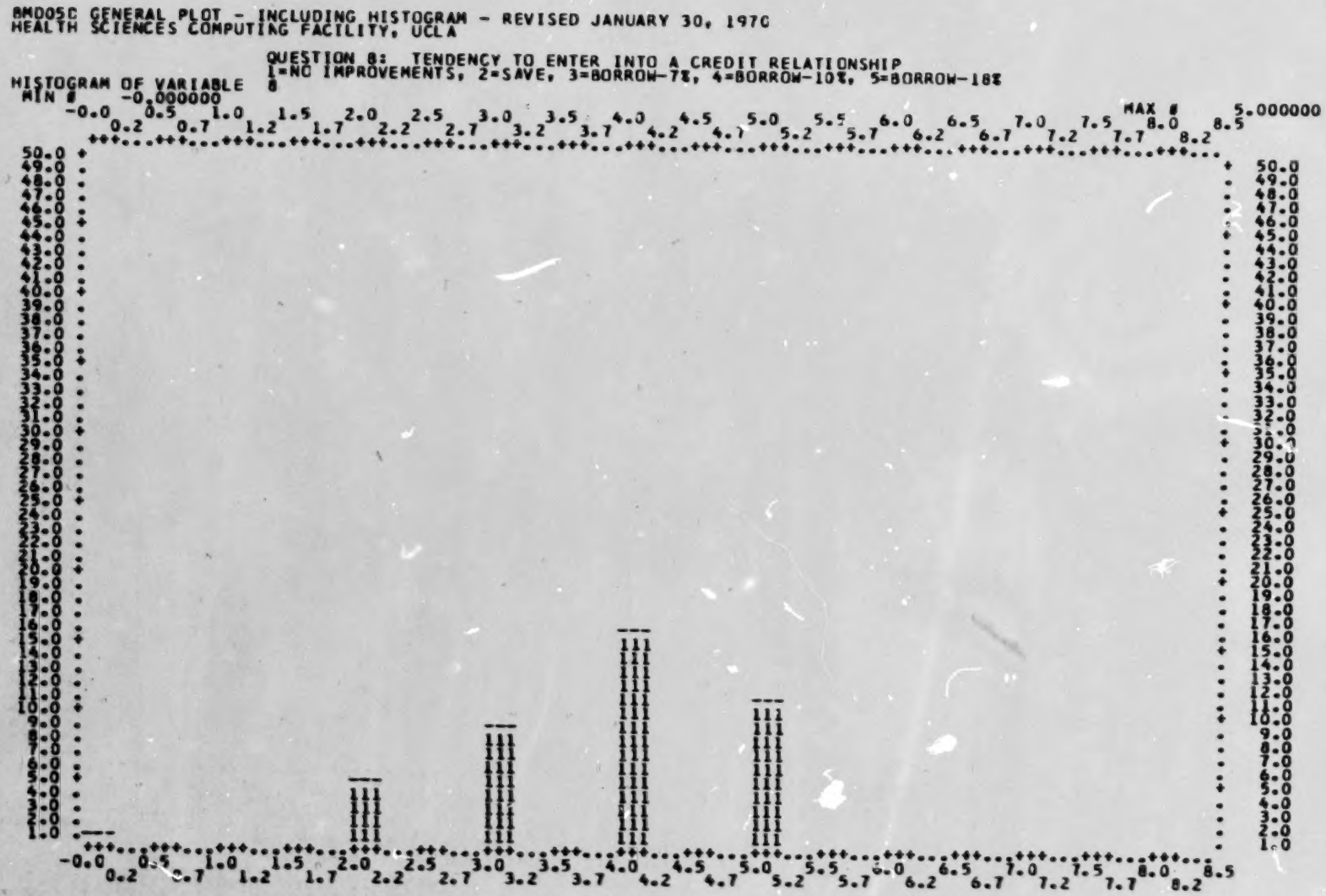
QUESTION 7: NUMBER OF TIMES YOU HAVE SOUGHT FURTHER INFORMATION
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE

HISTOGRAM OF VARIABLE 7

MIN # -0.000000 MAX # 5.000000




BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA
QUESTION 8: TENDENCY TO ENTER INTO A CREDIT RELATIONSHIP
1=NO IMPROVEMENTS, 2=SAVE, 3=BORROW-7%, 4=BORROW-10%, 5=BORROW-18%
HISTOGRAM OF VARIABLE 8
MIN # -0.000000
MAX # 5.000000

BMDO5D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUA[illegible]0, 197[illegible]
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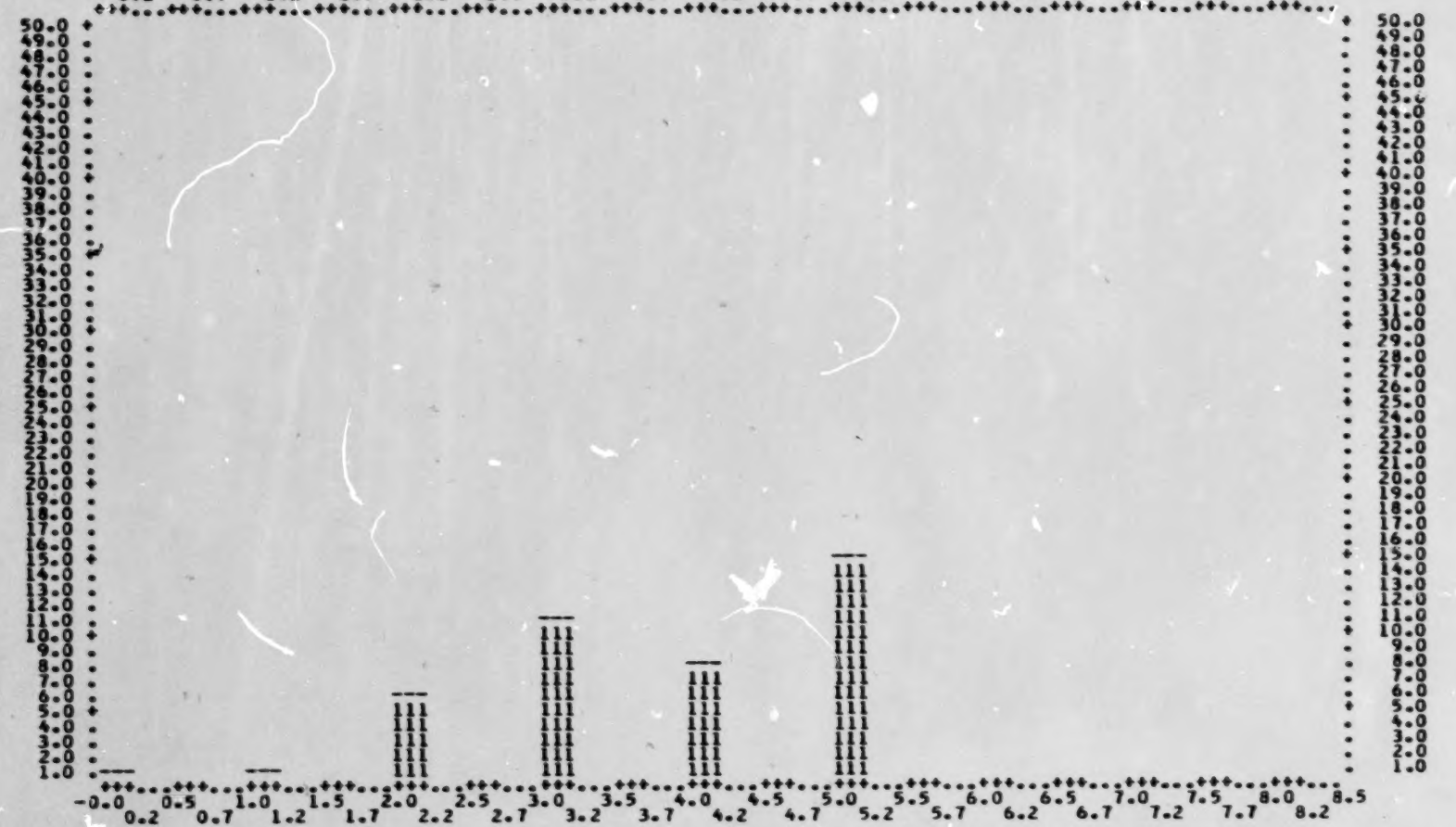
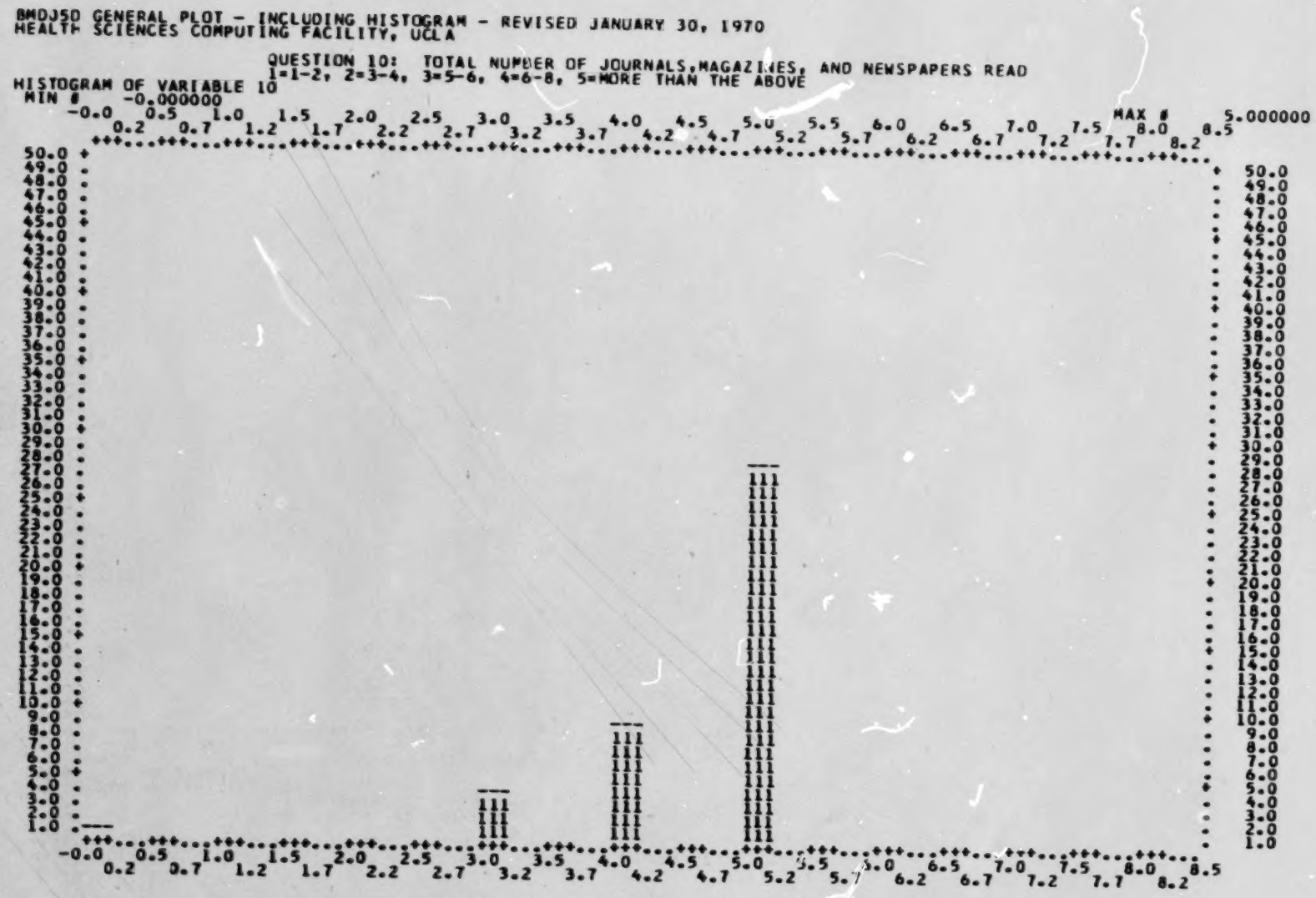
QUESTION 9: FREQUENCY PEERS, ETC CA[illegible] TO YOU IN THE PAST MONTH FOR INFO
1=1-3, 2=4-9, 3=10-15, 4=16-20, 5=MO[illegible] THAN THE ABOVE

HISTOGRAM OF VARIABLE 9
MIN # -0.000000 MAX # 5.000000




BMDJ5D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA
QUESTION 10: TOTAL NUMBER OF JOURNALS,MAGAZINES, AND NEWSPAPERS READ
1=1-2, 2=3-4, 3=5-6, 4=6-8, 5=MORE THAN THE ABOVE
HISTOGRAM OF VARIABLE 10
MIN # -0.000000
MAX # 5.000000

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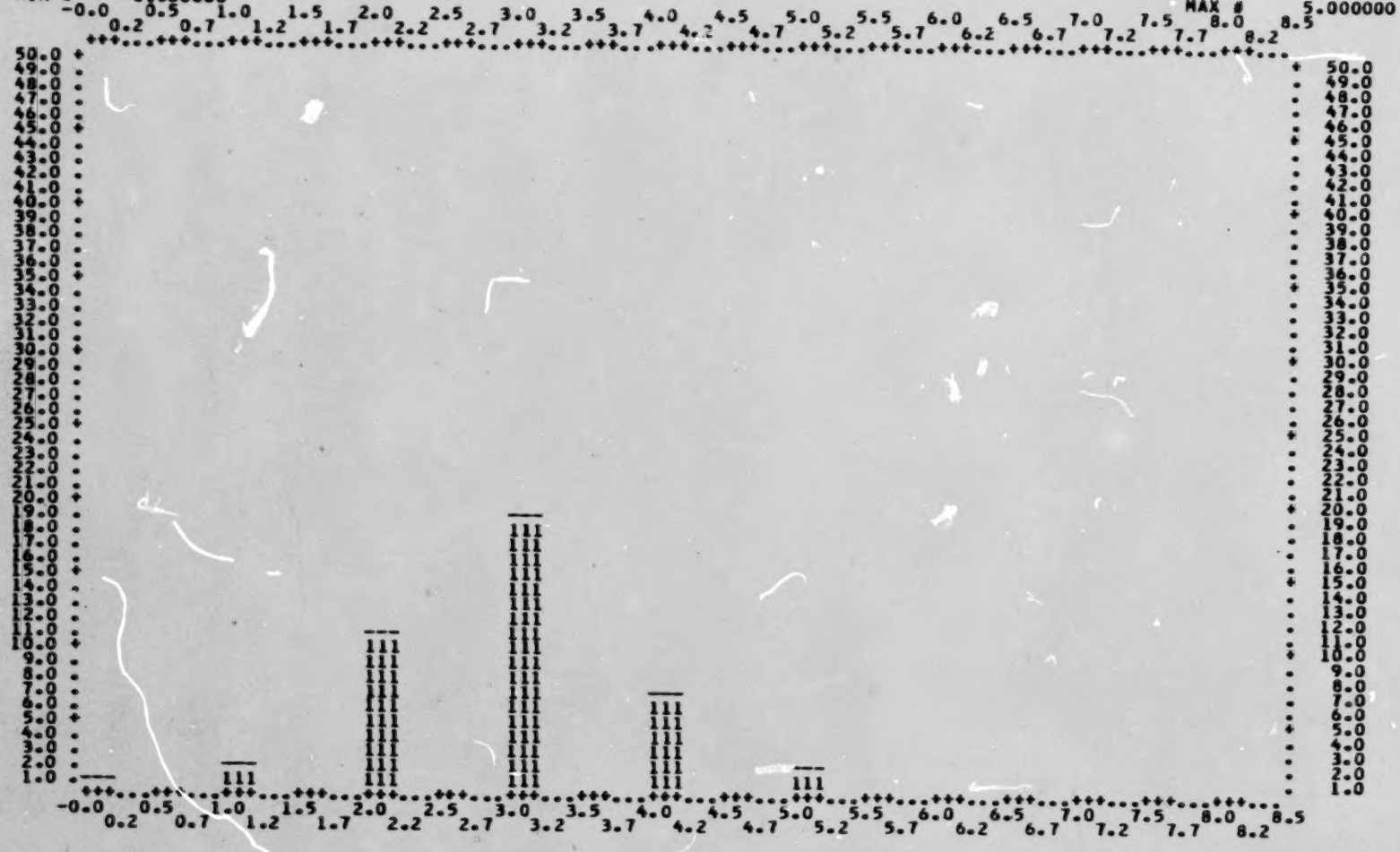
QUESTION 11: NUMBER OF SOCIETIES TO WHICH YOU HOLD CURRENT MEMBERSHIP
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE

HISTOGRAM OF VARIABLE 11
MIN # -0.000000 MAX # 5.000000



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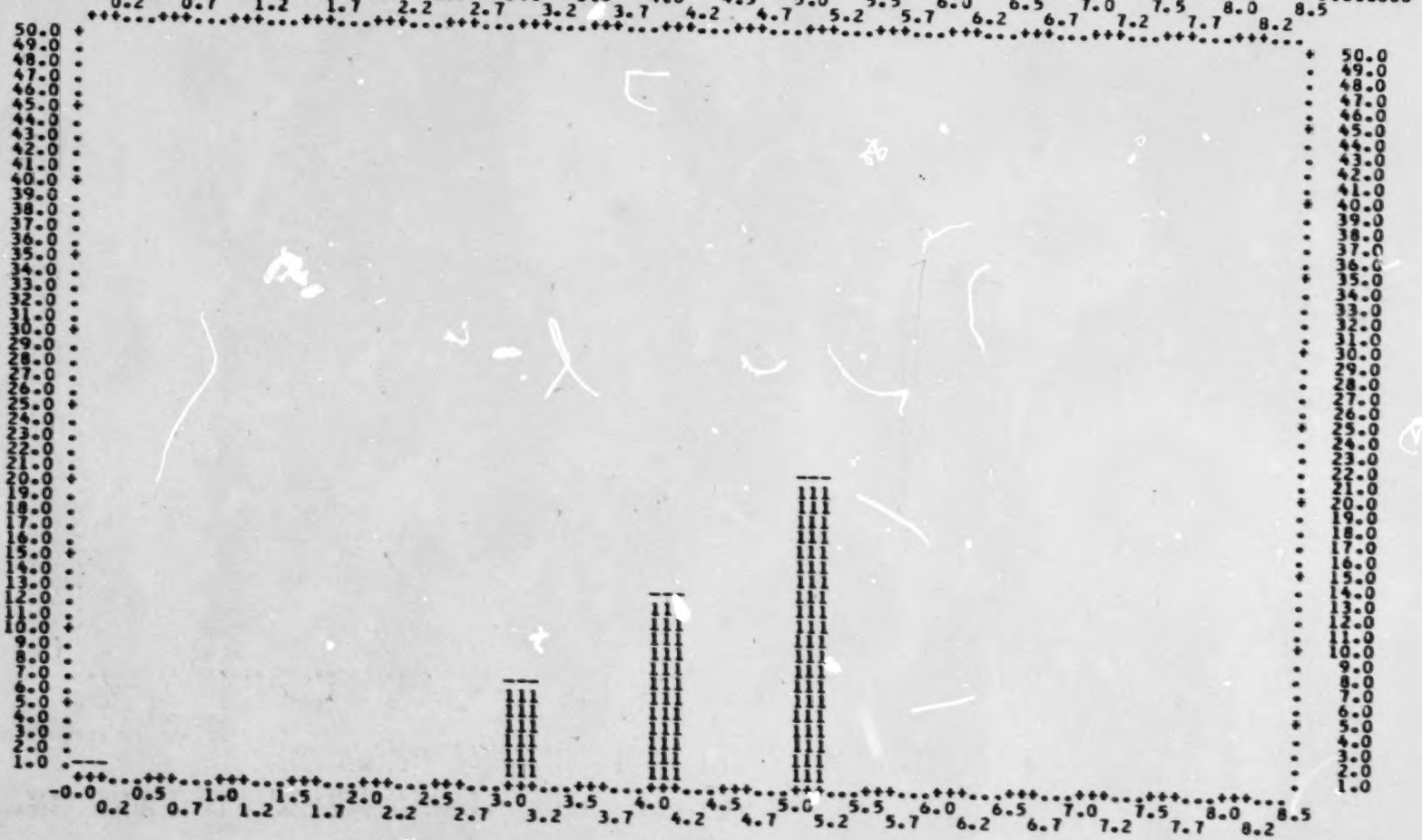
QUESTION 12: ASPIRED LEVEL IN THE SOCIAL STRATA 10 YEARS FROM NOW
1=LOWER-MIDDLE, 2=MIDDLE, 3=UPPER-MIDDLE, 4=LOWER-UPPER, 5=UPPER

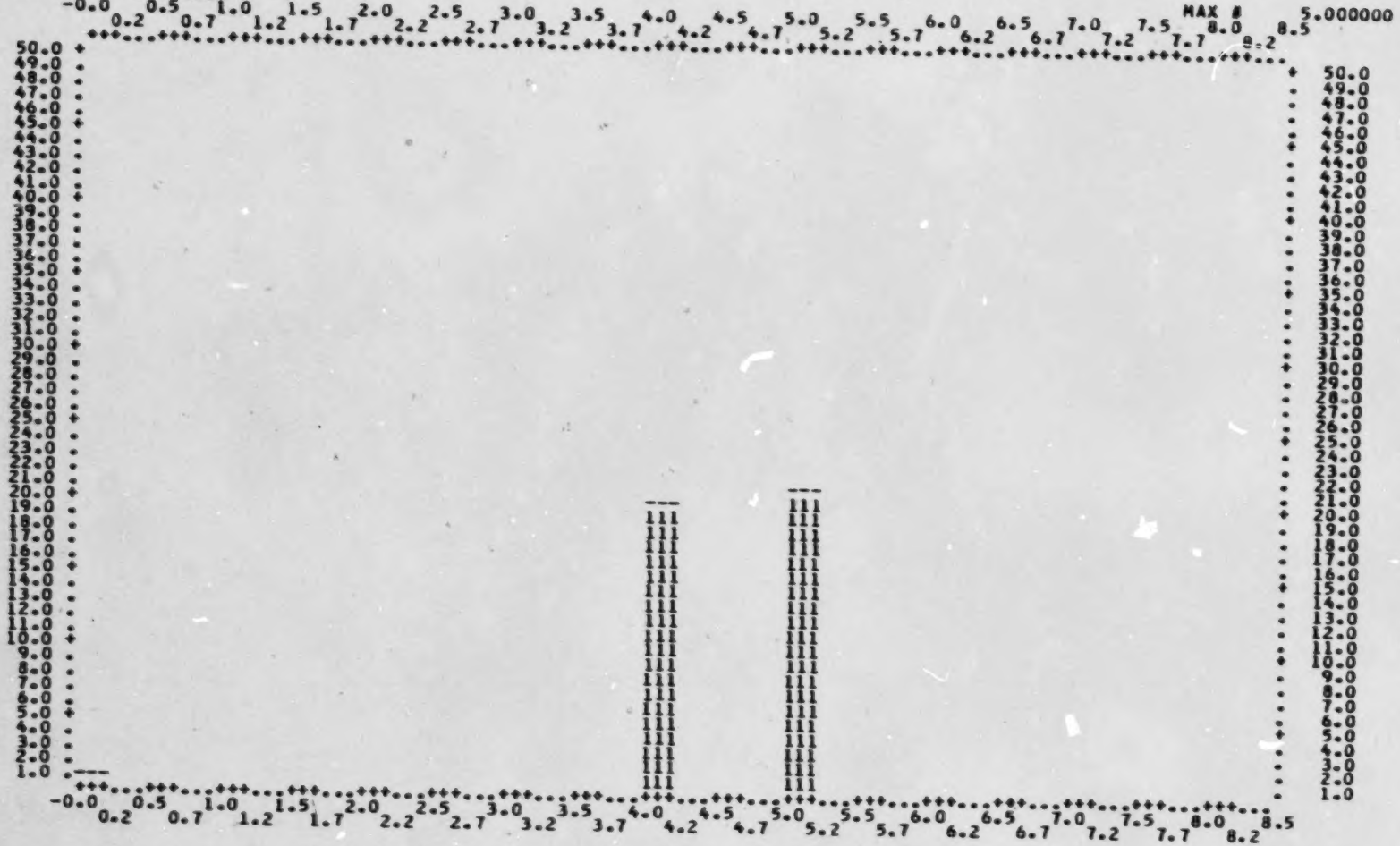
HISTOGRAM OF VARIABLE 12
MIN # -0.000000 MAX # 5.000000



BMD05C GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 13: TENDENCY TO PERCEIVE SELF AS VENTURESOME
1=WAIT, 2=CONSULTANT, 3=PROTOTYPE, 4=LOCAL PROJECT, 5=MAJOR PROJECT

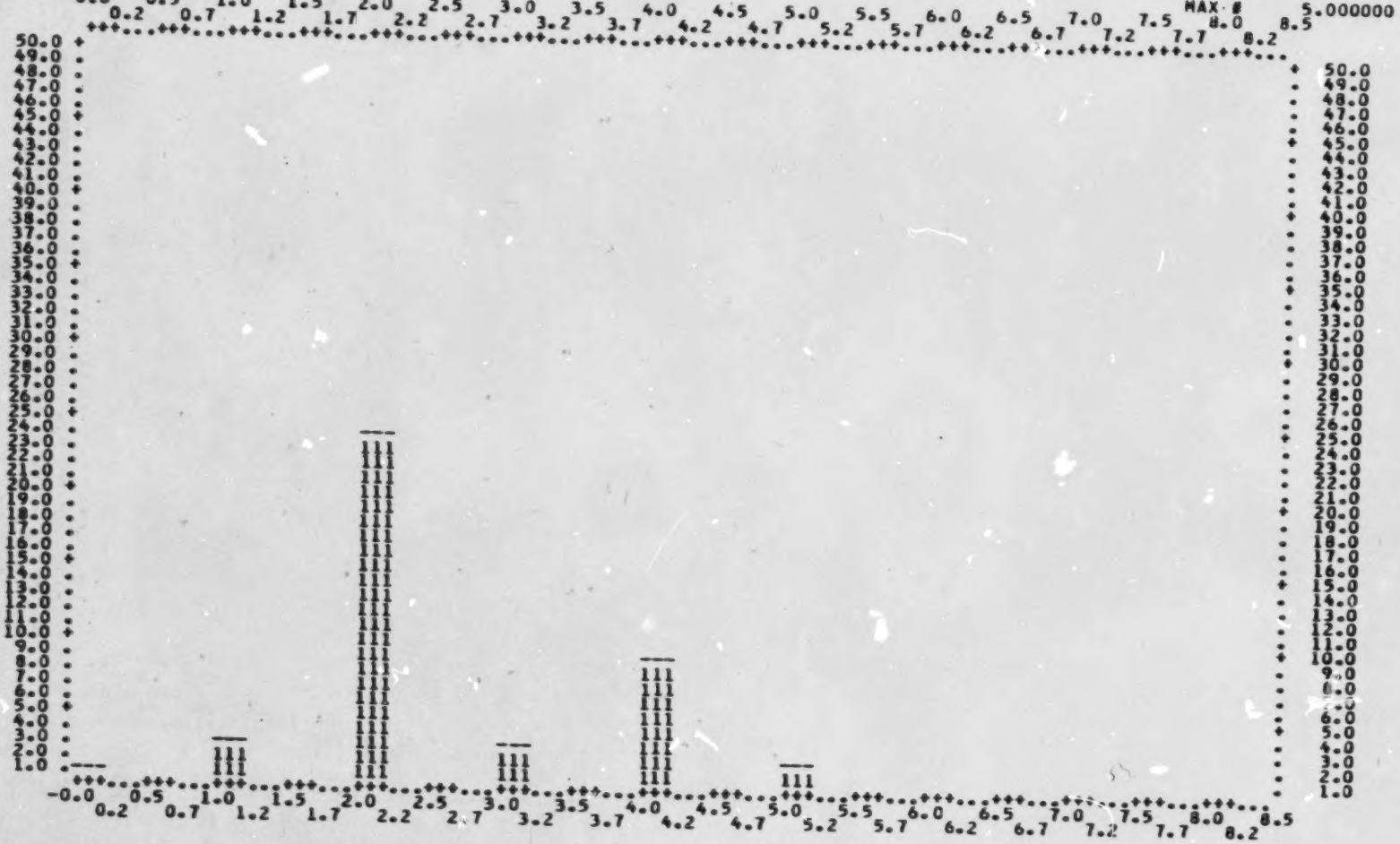
HISTOGRAM OF VARIABLE 13
MIN # -0.000000 MAX # 5.000000



BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 14: TECHNICAL INFO SOURCE UPON WHICH YOU MOST HEAVILY RELY
1=EXPERIENCE, 2=LITERATURE, 3=VENDORS, 4=STAFF, 5=EXTERNAL SOURCES

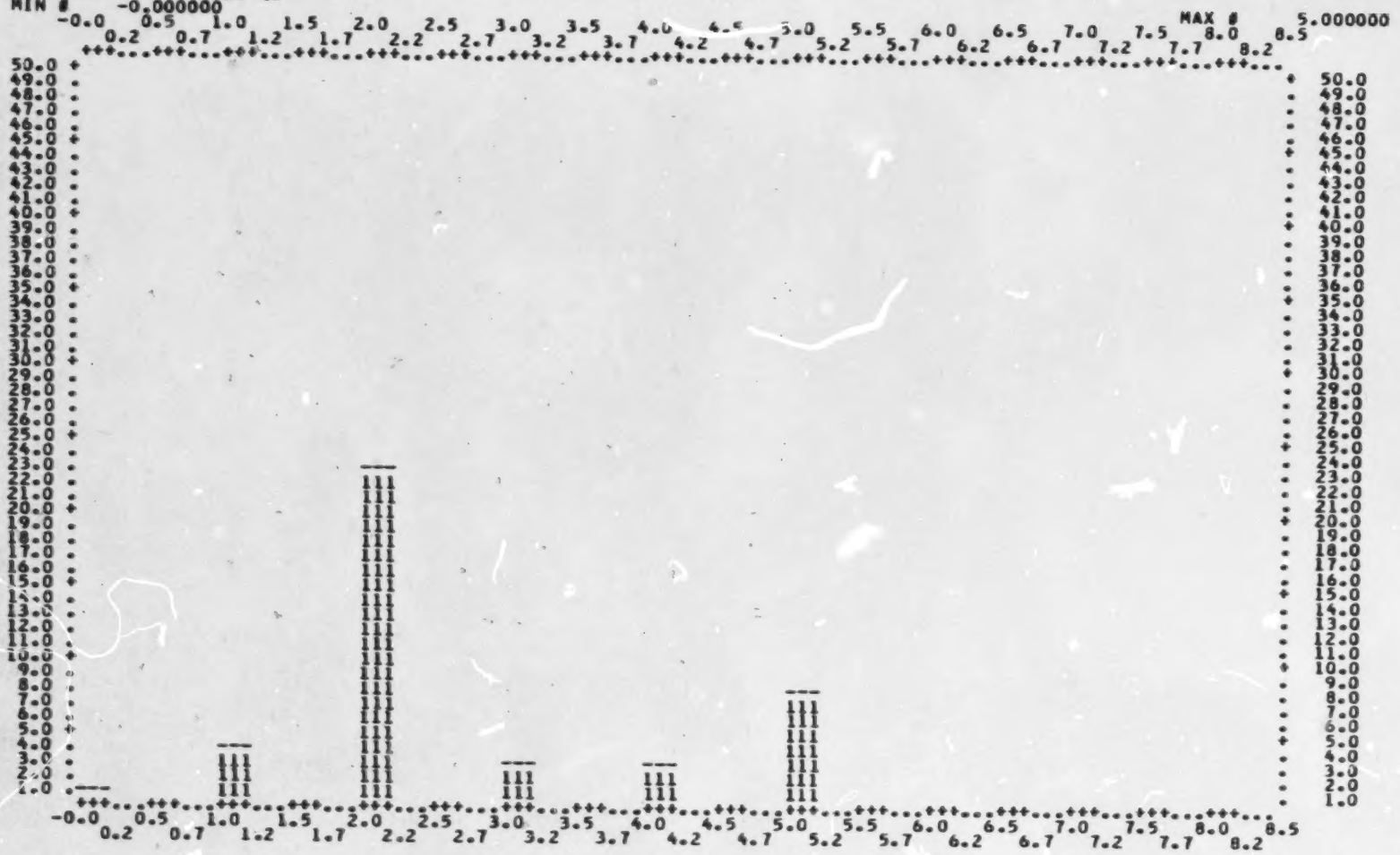
HISTOGRAM OF VARIABLE 14
MIN # -0.000000 MAX # 5.000000



BMD05C GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 15: GROUP OF PEOPLE TO WHOM YOU PRIMARILY RELATE
1=SPECIALIZED FIELD, 2=COLLEAGUES, 3=COMMUNITY, 4=OTHER, 5=NONE

HISTOGRAM OF VARIABLE 15
MIN # -0.000000 MAX # 5.000000

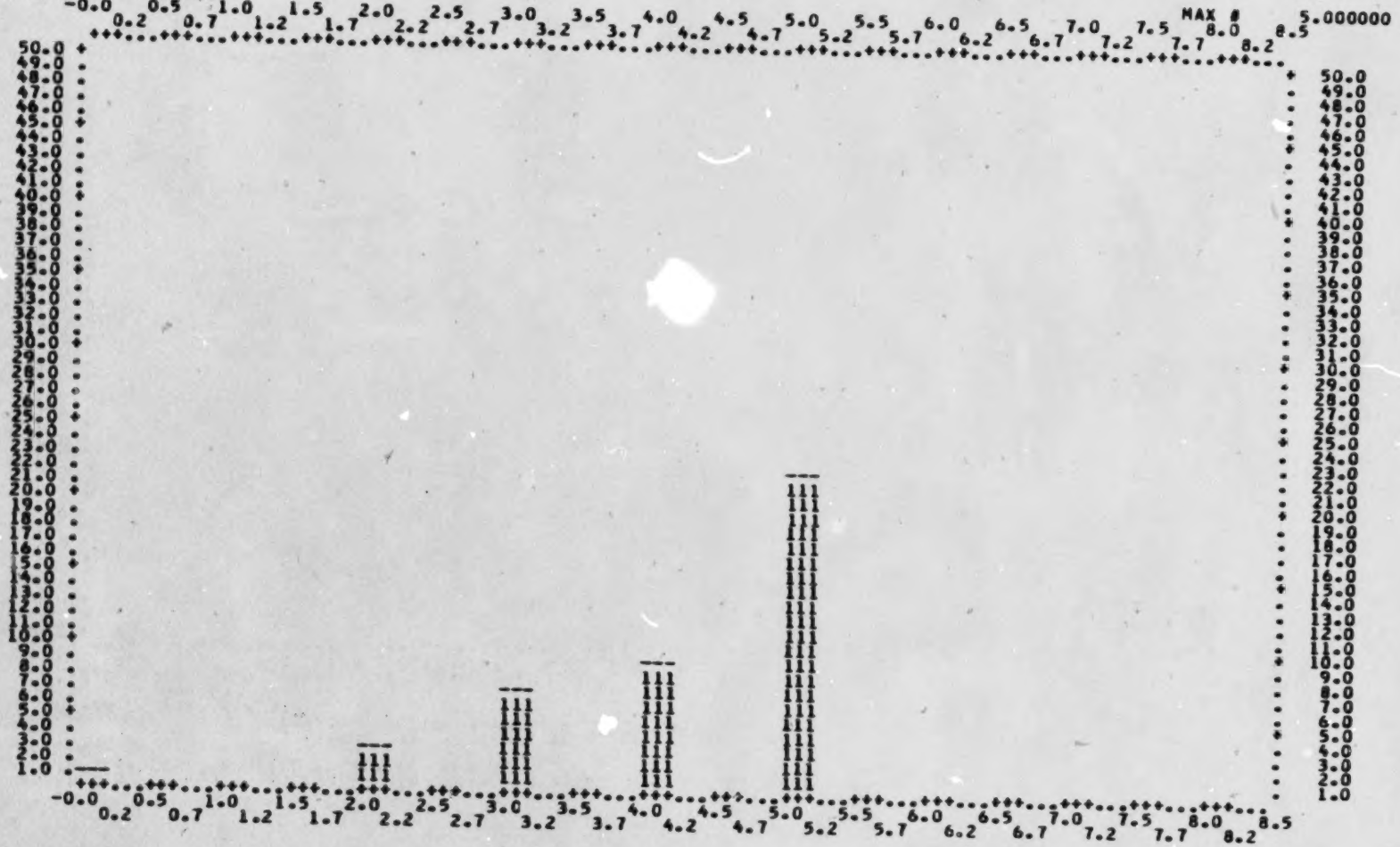


BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 16: FREQUENCY WITH WHICH YOU RECOMMENDED AN ITEM OF INTEREST
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE

HISTOGRAM OF VARIABLE 16

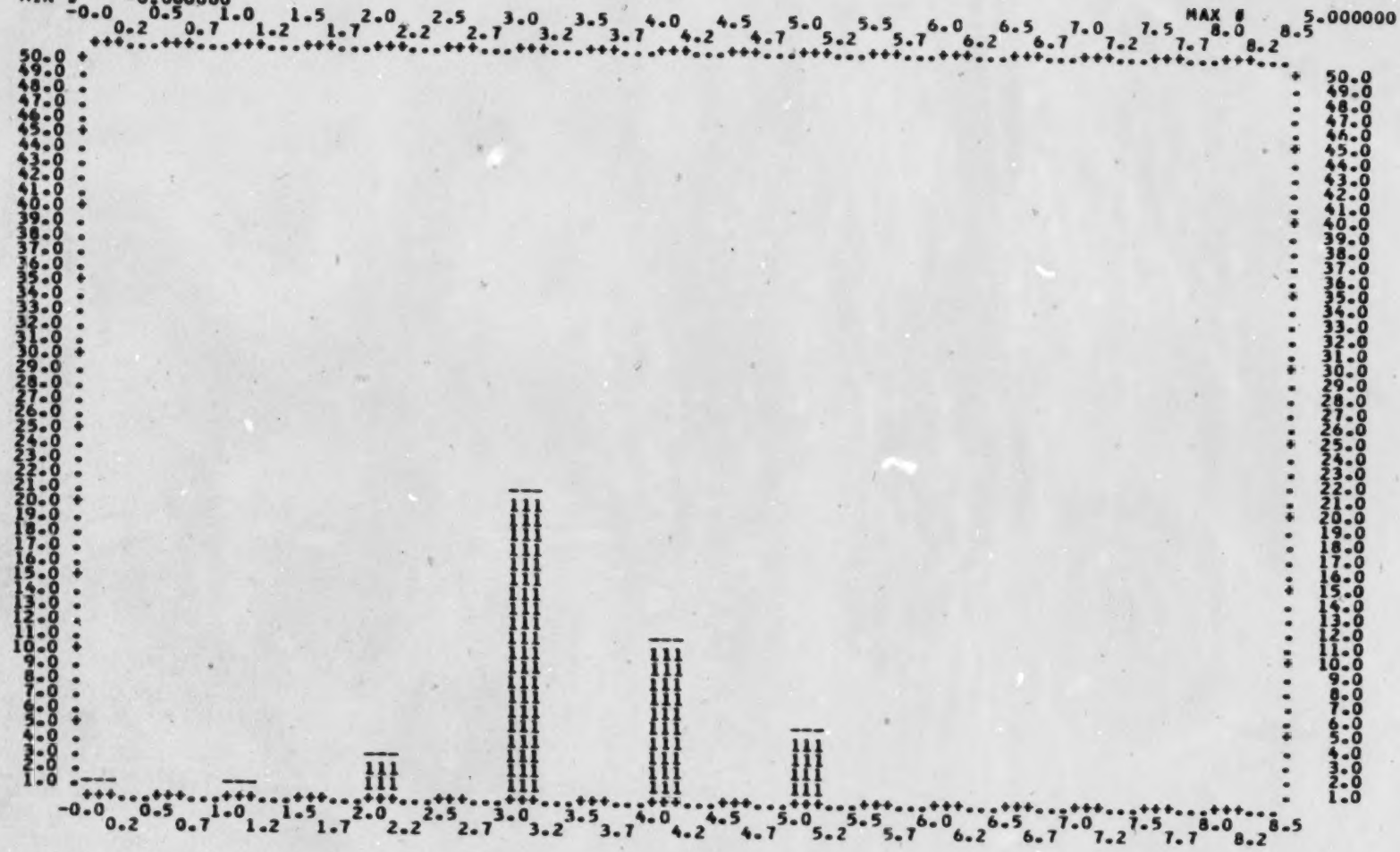
MIN # -0.000000 MAX # 5.000000

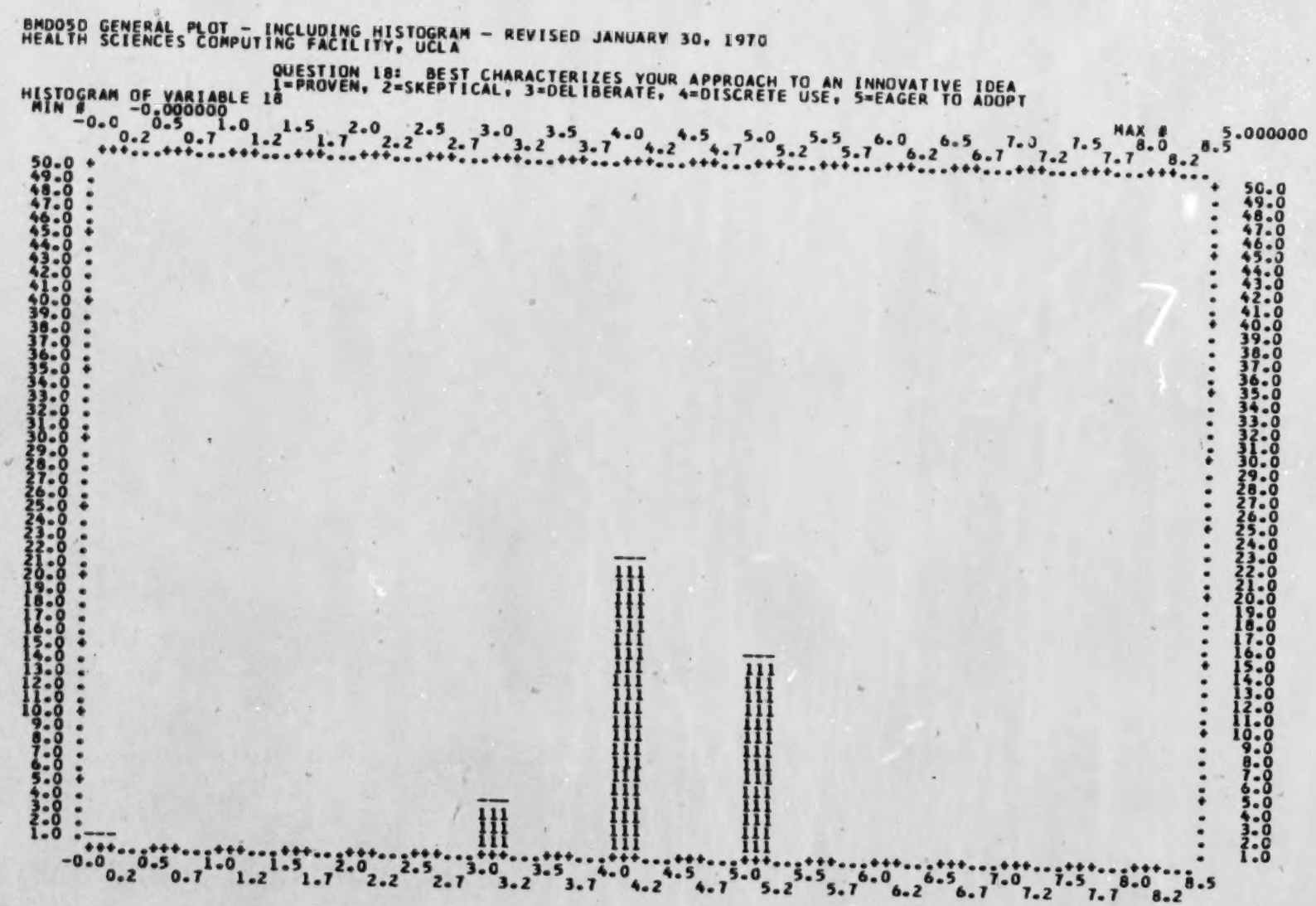


BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 17: TENDENCY TO ASSUME RISK
1=9/10, 2=7/10, 3=5/10, 4=3/10, 5=1/10

HISTOGRAM OF VARIABLE 17
MIN # -0.000000 MAX # 5.000000




BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
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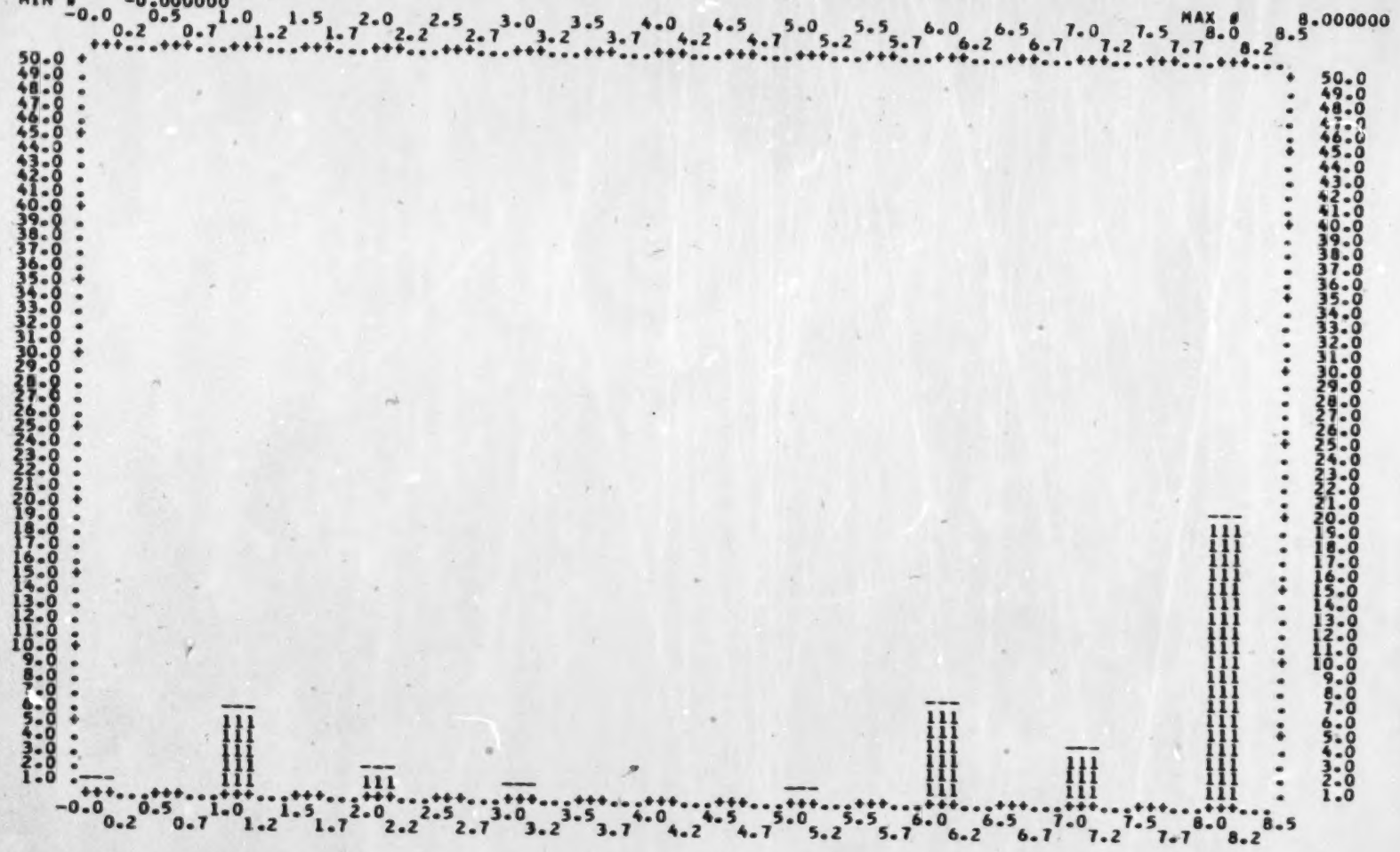
QUESTION 18: BEST CHARACTERIZES YOUR APPROACH TO AN INNOVATIVE IDEA
1=PROVEN, 2=SKEPTICAL, 3=DELIBERATE, 4=DISCRETE USE, 5=EAGER TO ADOPT
HISTOGRAM OF VARIABLE 18
MIN # -0.000000
MAX # 5.000000

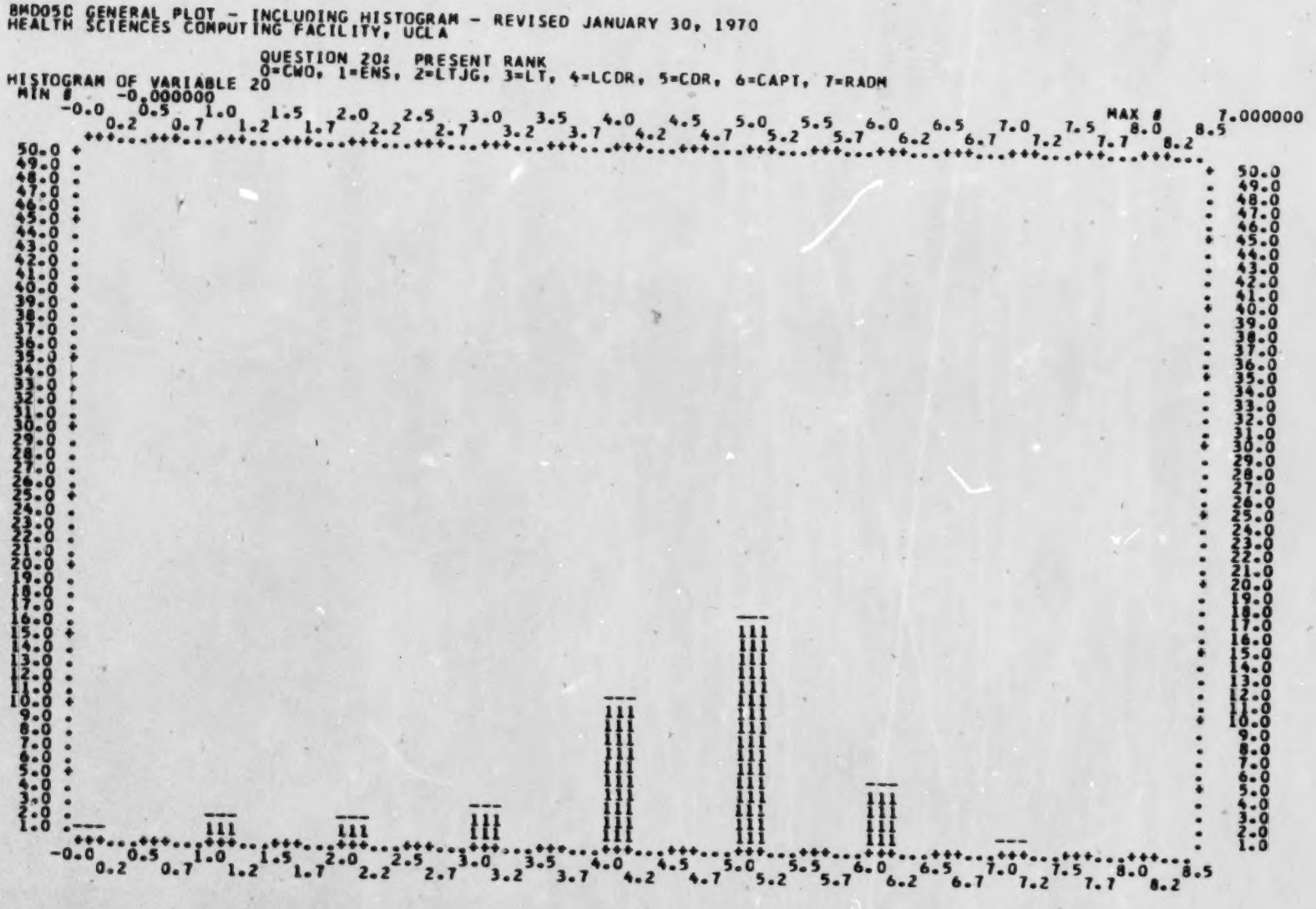
BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 19: TYPE OF ORGANIZATION IN WHICH YOU ARE WORKING
1=PHO, 2=OICC, 3=ROICC, 4=COMB, 5=DUIN, 6=EFD, 7=CB, 8=OTHER

HISTOGRAM OF VARIABLE 19

MIN # -0.000000 MAX # 8.000000

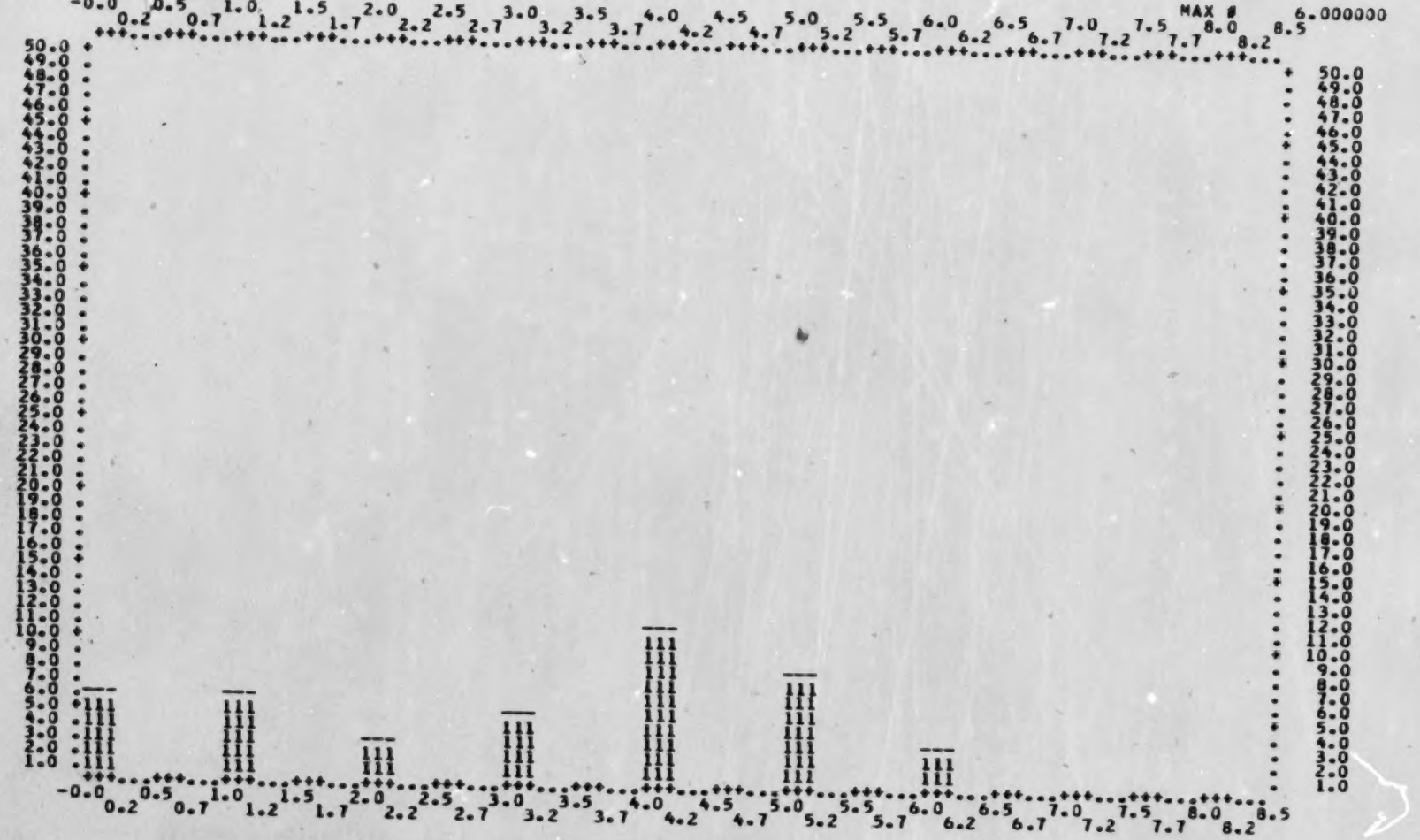


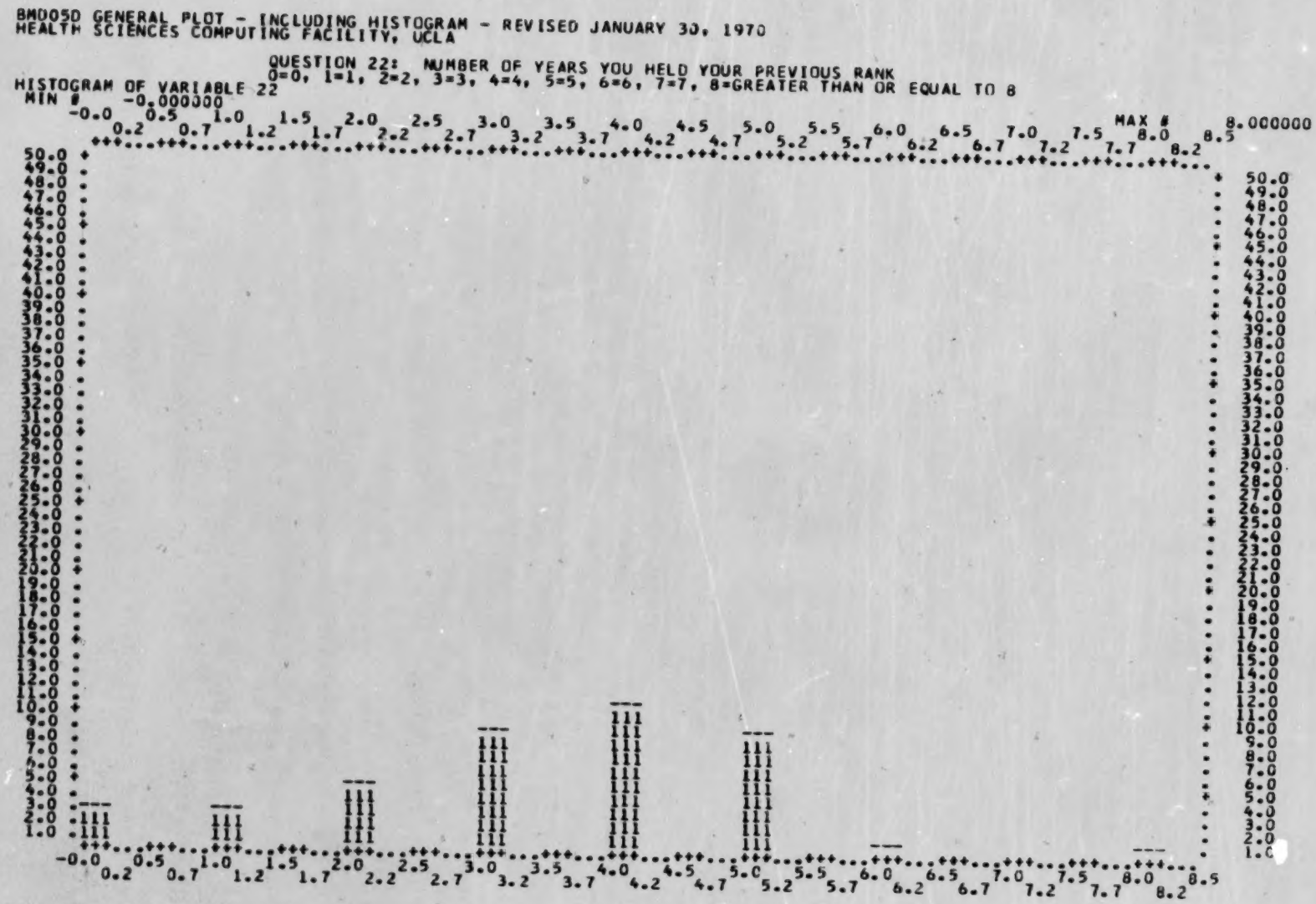

BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA
QUESTION 20: PRESENT RANK
0=CWO, 1=ENS, 2=LTJG, 3=LT, 4=LCDR, 5=CDR, 6=CAPT, 7=RADM
HISTOGRAM OF VARIABLE 20
MIN # -0.000000
MAX # 7.000000

BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 21: NUMBER OF YEARS YOU HAVE HELD YOUR PRESENT RANK
0=0, 1=1, 2=2, 3=3, 4=4, 5=5, 6=6, 7=7, 8=GREATER THAN OR EQUAL TO 8

HISTOGRAM OF VARIABLE 21
MIN # -0.000000 MAX # 6.000000




BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA
QUESTION 22: NUMBER OF YEARS YOU HELD YOUR PREVIOUS RANK
0=0, 1=1, 2=2, 3=3, 4=4, 5=5, 6=6, 7=7, 8=GREATER THAN OR EQUAL TO 8
HISTOGRAM OF VARIABLE 22
MIN # -0.000000
MAX # 8.000000

Appendix Nine

Histogram of Individual Questions, Response of Stabilizers Only

Each of the 22 questions which are a part of the RPPC have been plotted as a histogram to show the distribution of answers. At the top of the histogram the question number is listed together with a very brief statement of the question. The complete text of the question may be found by referring to the RPPC which is Appendix 3. The respondent indicated an A through E choice for his answer to each question. For data processing the A through E answer has been translated into a numerical value of 1 through 5. The relationship of the letter to the number will vary depending upon the question. The coding of the questions is shown as Appendix 3. The coding was arranged so that a 1 would indicate a tendency toward a stabilizer while a 5 would indicate a tendency toward a linker.

As stated before, the individual question answer in itself does not identify a person operating as a linker, but rather the aggregate score for all questions.

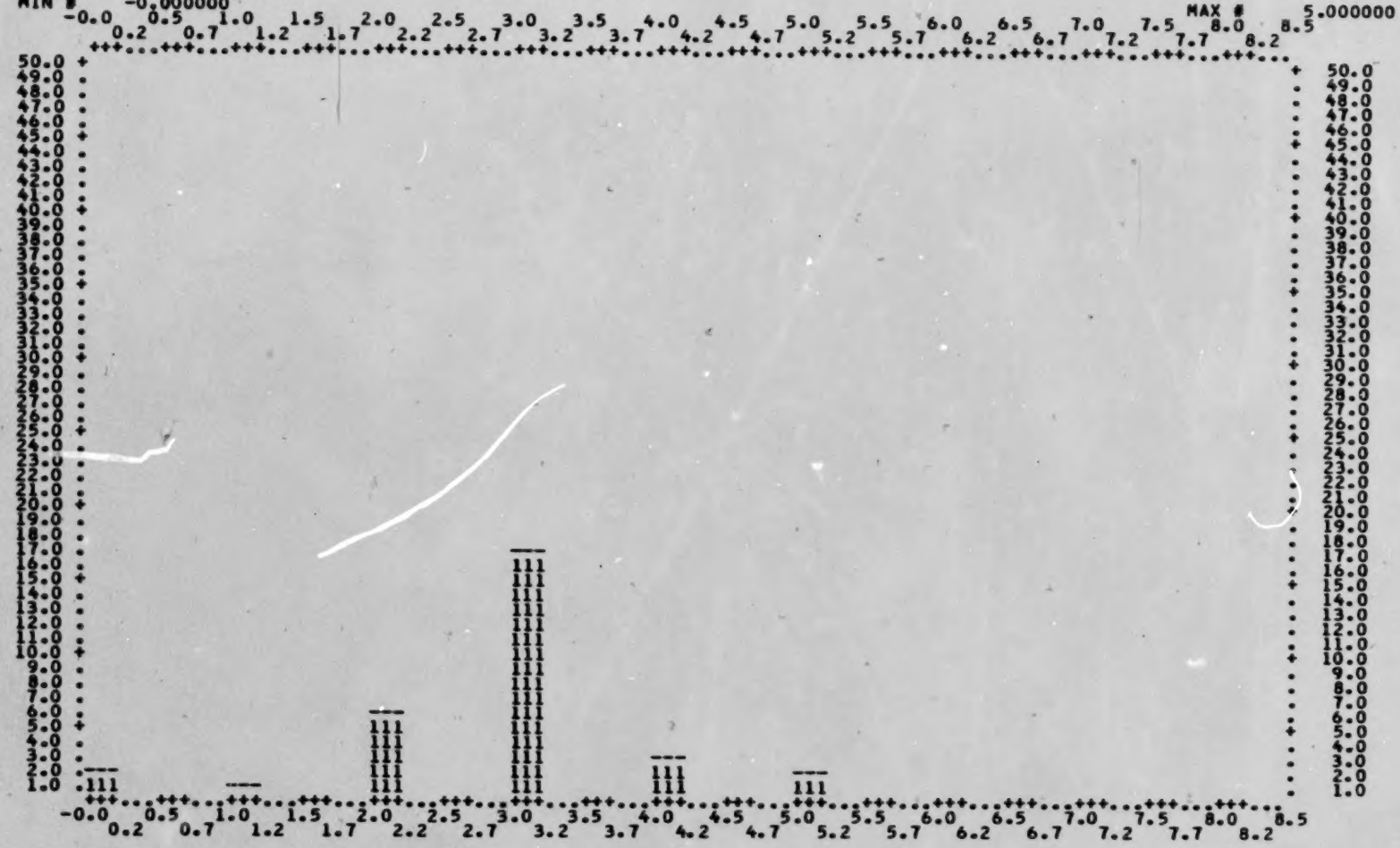
When the histogram for question 1 of a Linker is compared to the histogram of question 1 of the linkers [Appendix 8]. It is possible to observe the relative difference in interests, self perception and/or performance that has been predicted by the research cited in the text of this report. This observed difference in the histograms is referred to as discrimination. As would be expected some of the questions show very good discrimination while others tend to show only small discrimination. Each question was statistically tested for this dsicriminate characteristic by using multiple discriminate analysis which is discussed in the section of the text titled, "RPPC Multiple Discriminate Analysis."

When studying the histograms it is useful to note that the Ordinate is the number of responses to a particular option of the question and the obscissa has among its values the cardinal numbers 1, 2, 3, 4 and 5 which are related to the code shown above the Histogram.

BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 1: HIGHEST RANK TO WHICH YOU WOULD ASPIRE
1=LCRD, 2=CDR, 3=CAPT, 4=RADM, 5=ADM

HISTOGRAM OF VARIABLE 1
MIN # -0.000000 MAX # 5.000000

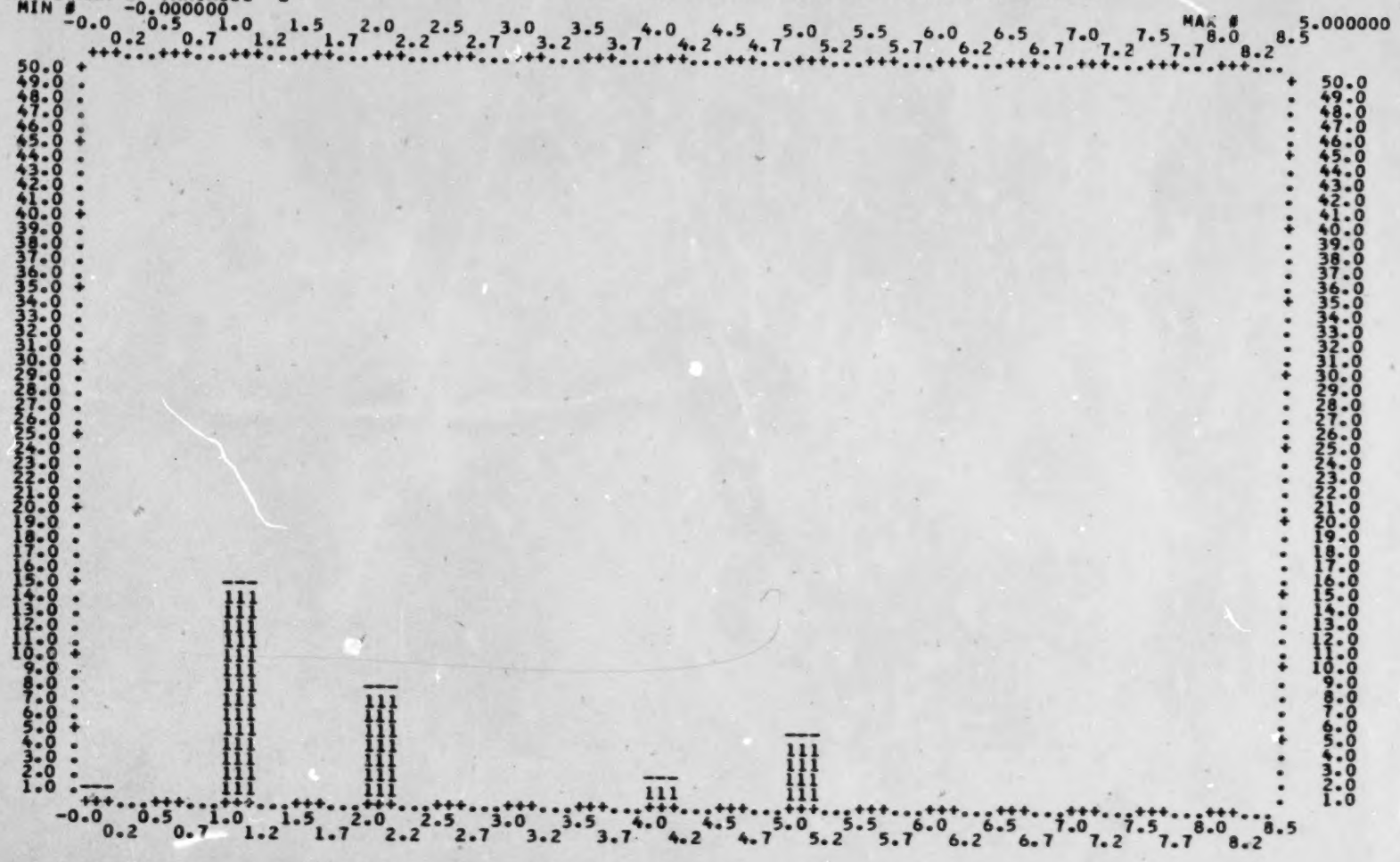


BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 2: INFORMATION ON WHICH YOU WOULD PLACE HIGHEST CREDIBILTY
1=ANAL & EXPER, 2=LITERATURE, 3=VENDORS, 4=STAFF, 5=PERSONAL KNOWLEDGE

HISTOGRAM OF VARIABLE 2

MIN # -0.000000 MAX # 5.000000



BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
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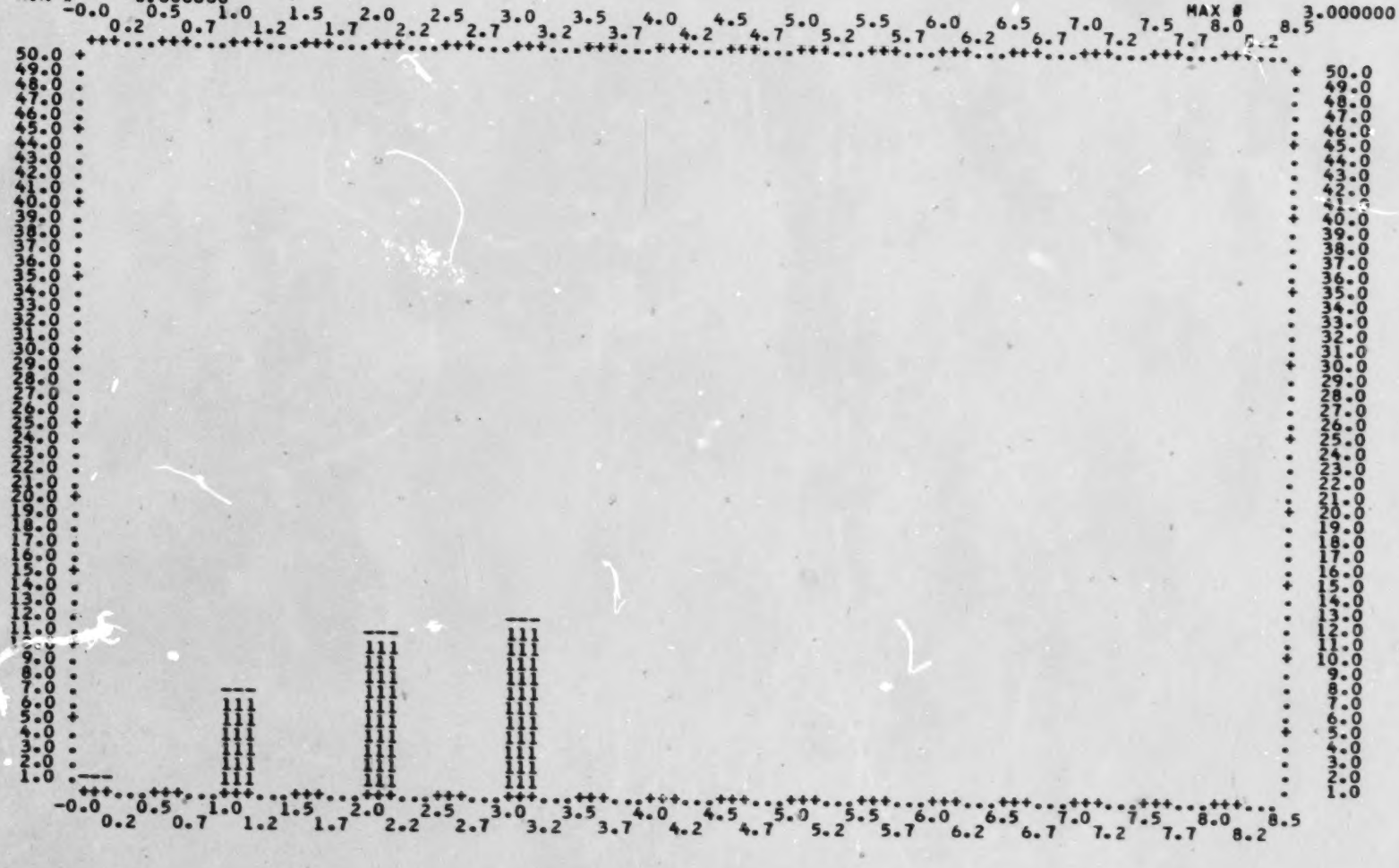
QUESTION 3: WHEN YOU HEAR ABOUT NEW WORK-RELATED DEVELOPMENTS
1=AFTER, 2=LATER THAN, 3=SAME TIME, 4=SOONER THAN, 5=CONSIDERABLY BEFORE

HISTOGRAM OF VARIABLE 3
MIN # -0.000000 MAX # 3.000000

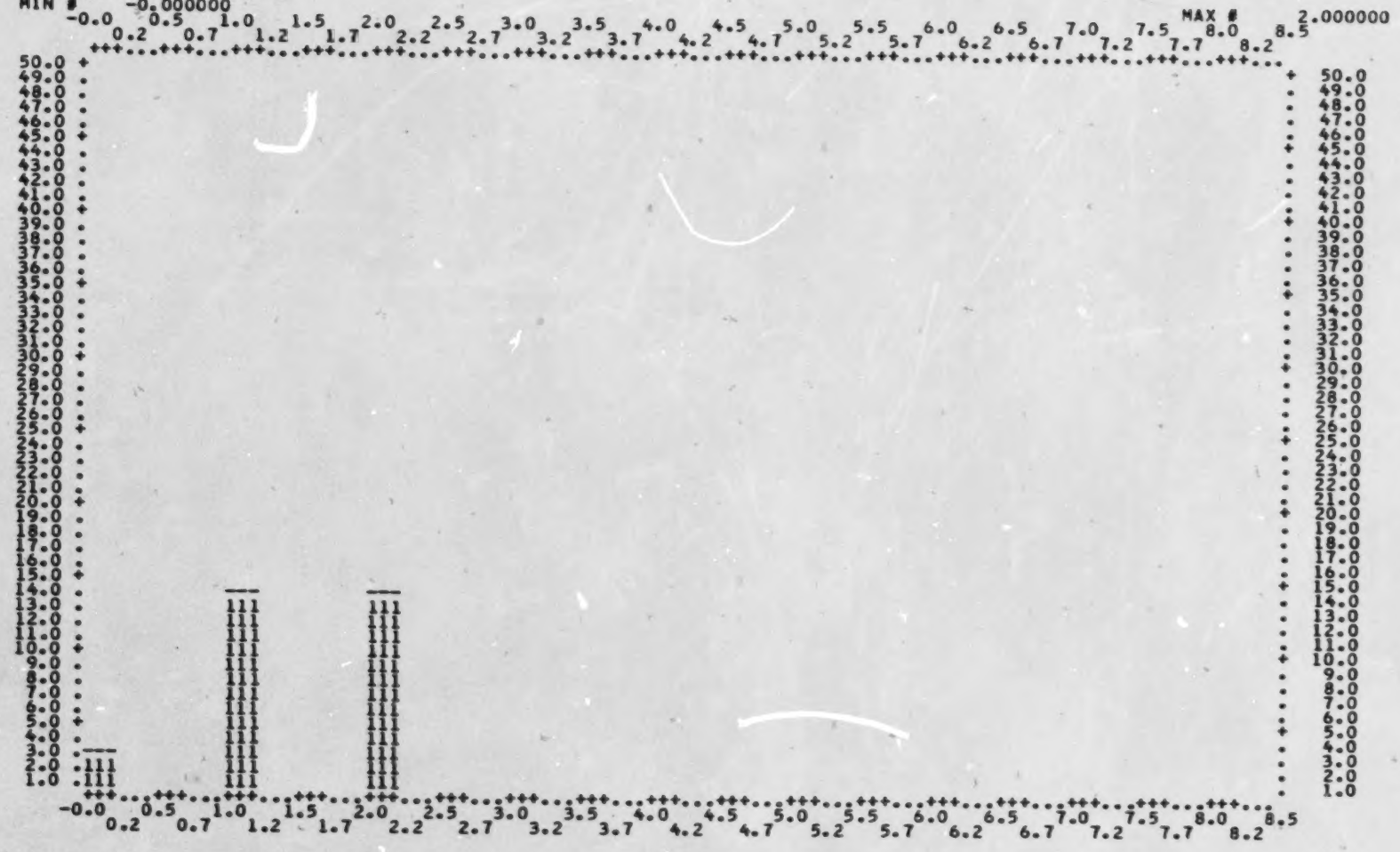


BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 4: WORK-RELATED PROJECTS FOR WHICH YOU SUPPLIED THE IDEA
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE

HISTOGRAM OF VARIABLE 4

MIN # -0.000000 MAX # 2.000000

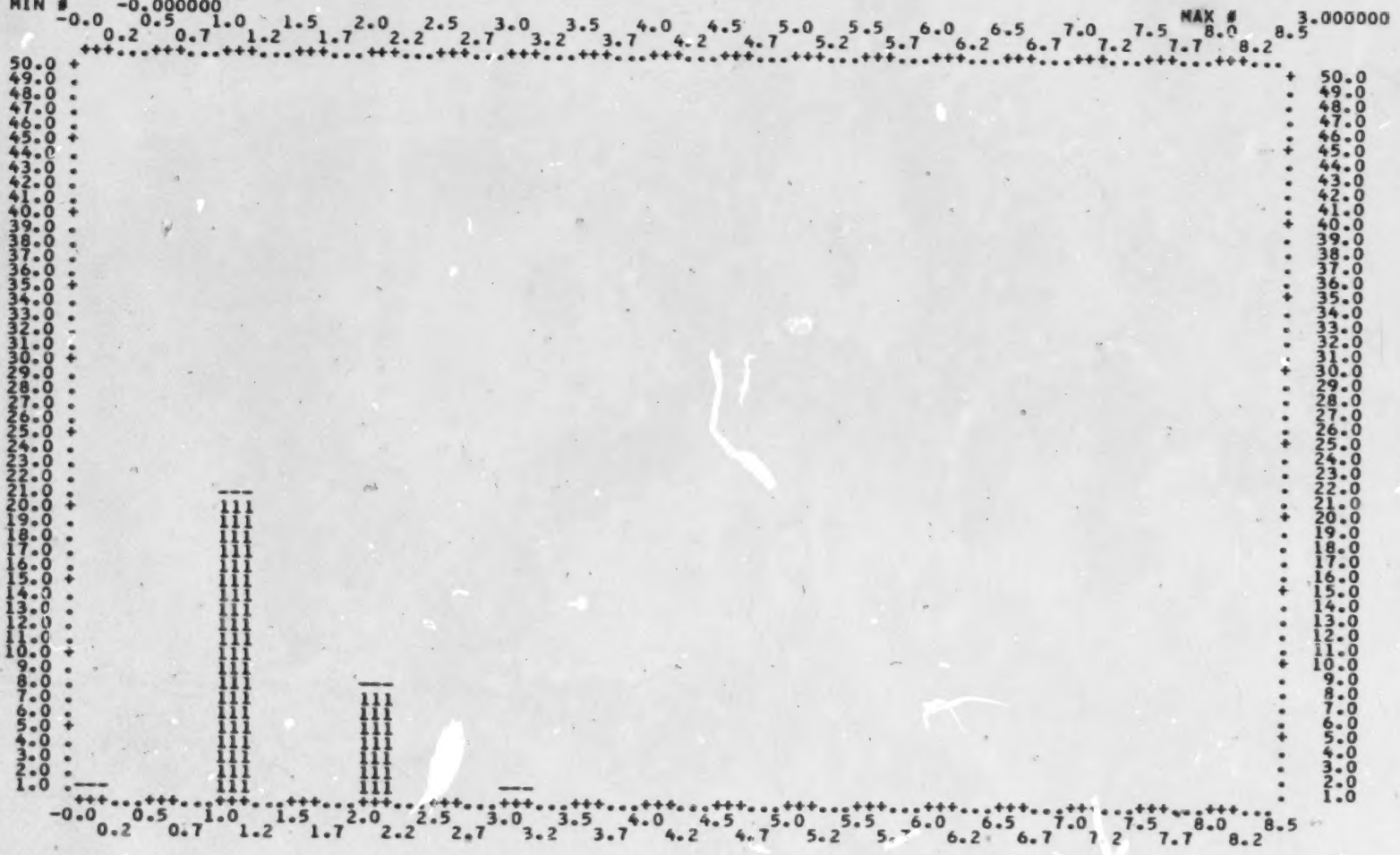


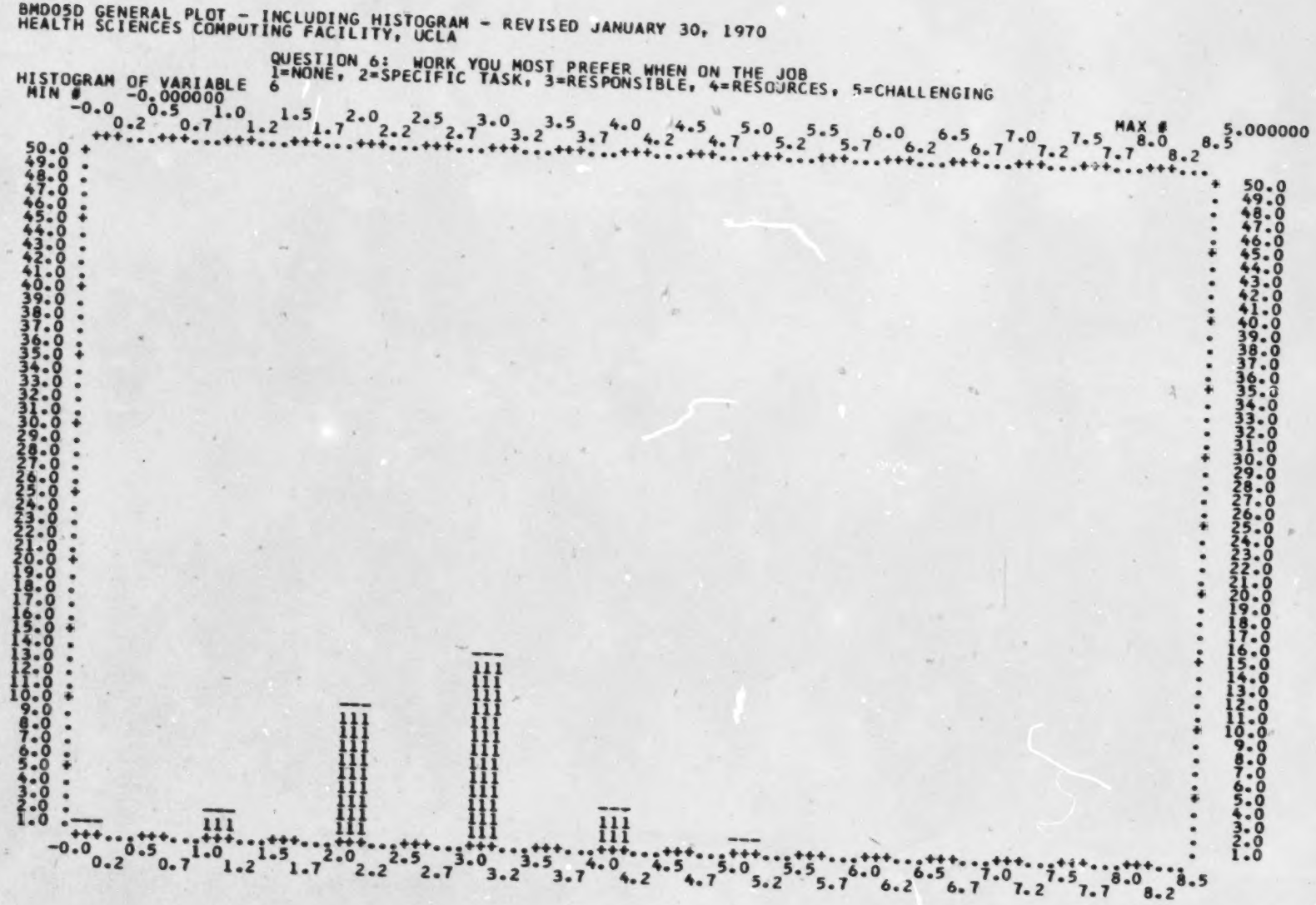
BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 5: NUMBER OF SCIENTIFIC SOCIETY MEETINGS ATTENDED LAST YEAR
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE

HISTOGRAM OF VARIABLE 5

MIN # -0.000000 MAX # 3.000000

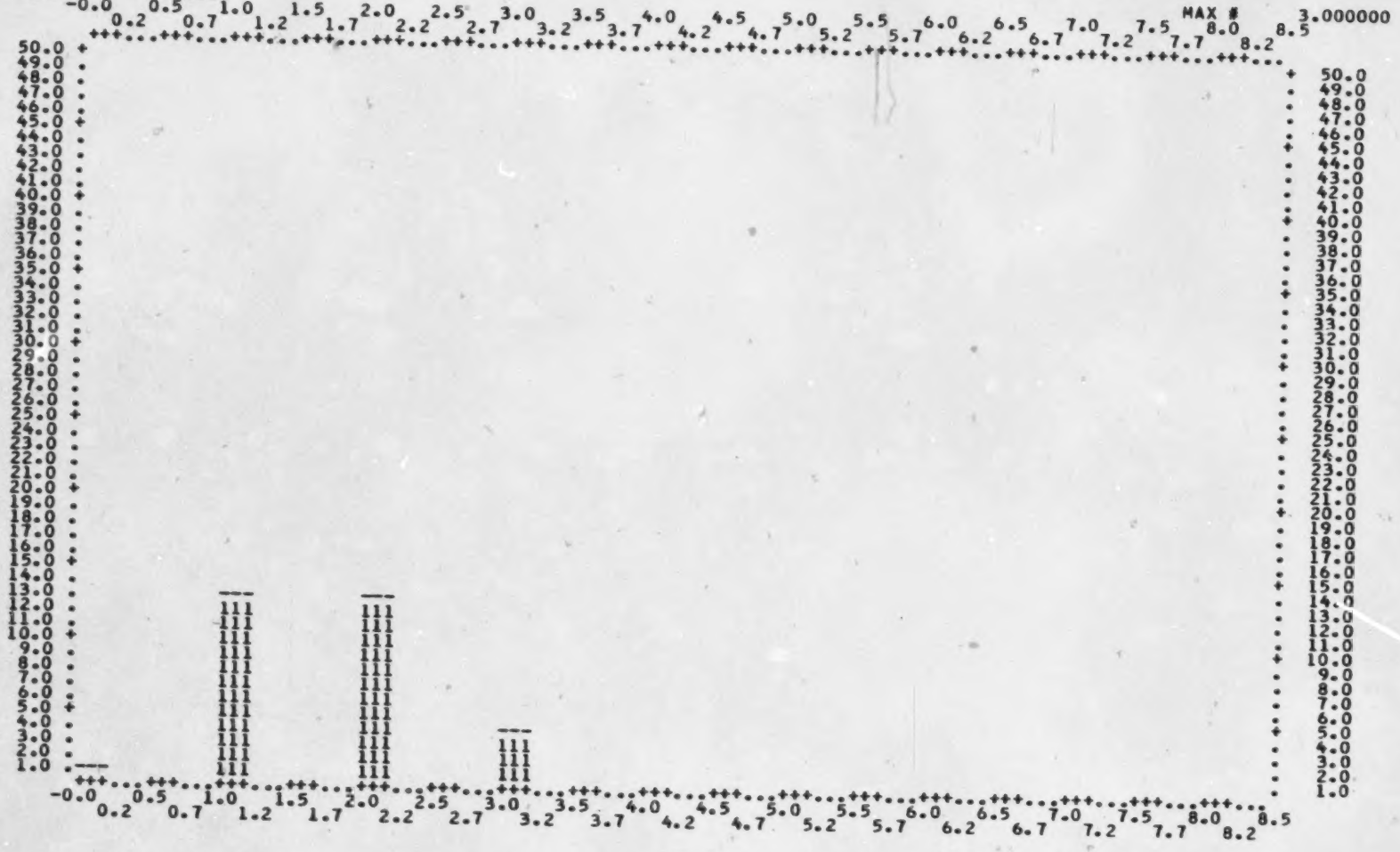



BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA
QUESTION 6: WORK YOU MOST PREFER WHEN ON THE JOB
1=NONE, 2=SPECIFIC TASK, 3=RESPONSIBLE, 4=RESOURCES, 5=CHALLENGING
HISTOGRAM OF VARIABLE 6
MIN # -0.000000
MAX # 5.000000

BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 7: NUMBER OF TIMES YOU HAVE SOUGHT FURTHER INFORMATION
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE

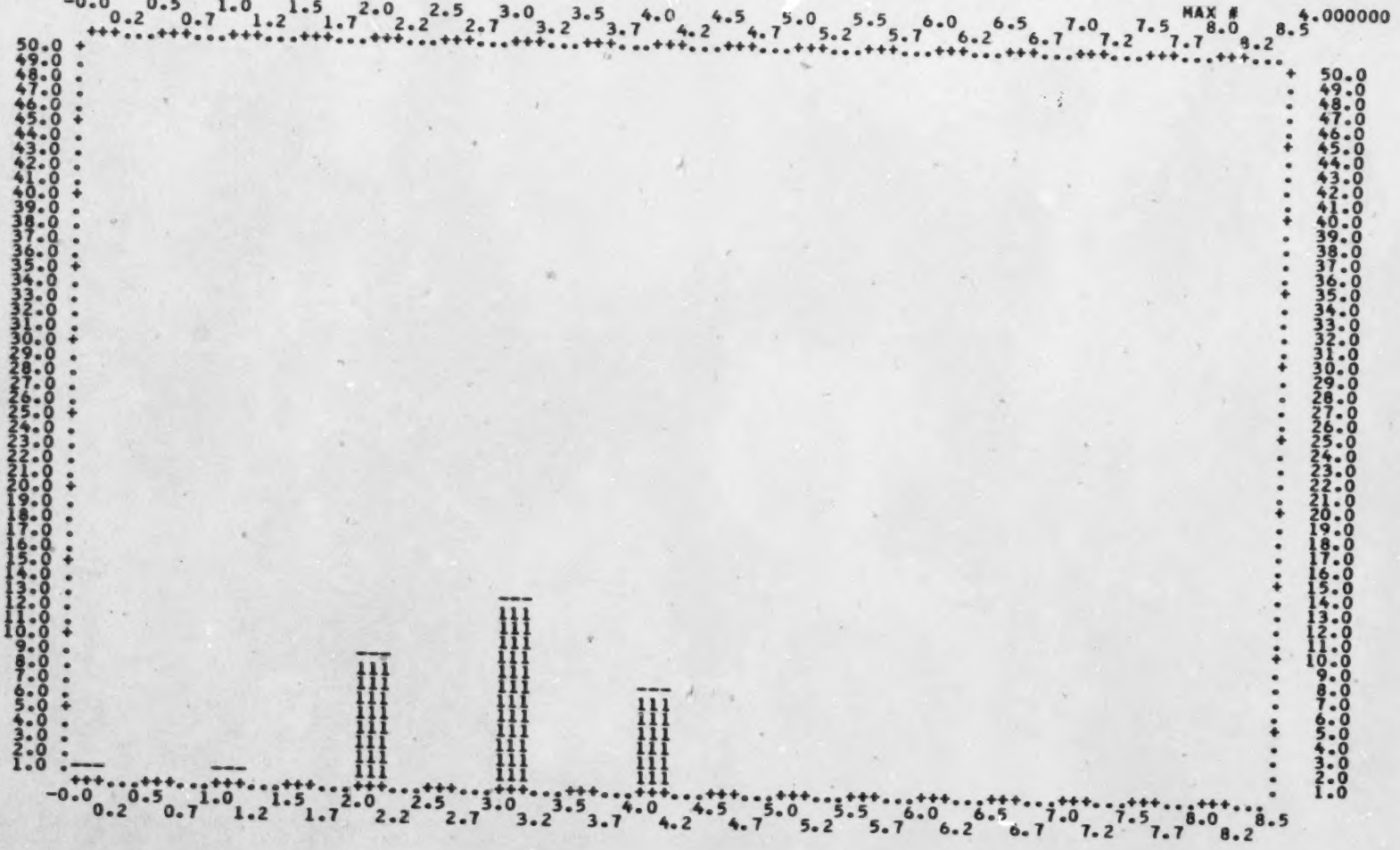
HISTOGRAM OF VARIABLE 7
MIN # -0.000000 MAX # 3.000000



BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 8: TENDENCY TO ENTER INTO A CREDIT RELATIONSHIP
1=NO IMPROVEMENTS, 2=SAVE, 3=BORROW-7%, 4=BORROW-10%, 5=BORROW-18%

HISTOGRAM OF VARIABLE 8
MIN # -0.000000 MAX # 4.000000



BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
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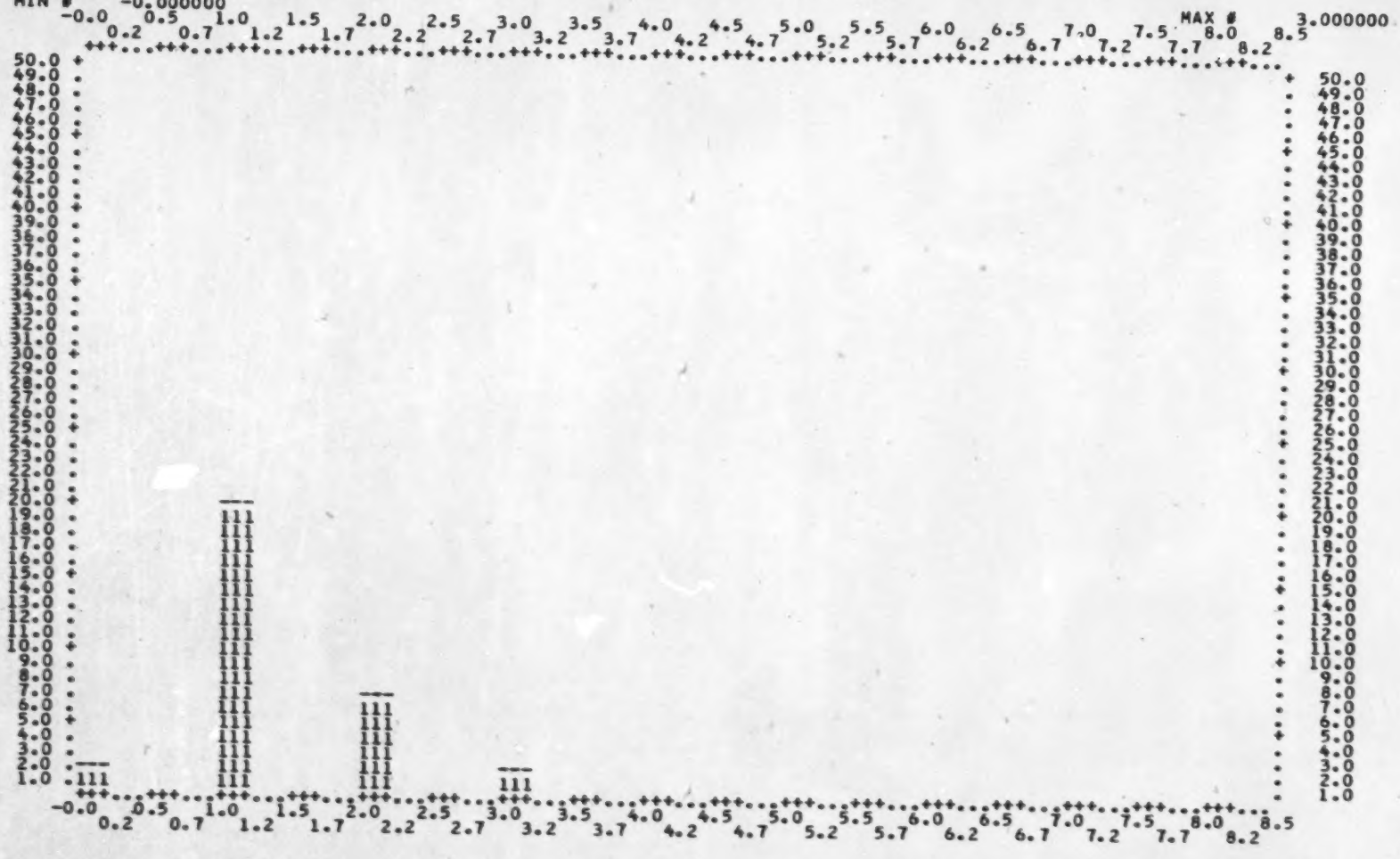
QUESTION 9: FREQUENCY PEERS, ETC CAME TO YOU IN THE PAST MONTH FOR INFO
1=1-3, 2=4-9, 3=10-15, 4=16-20, 5=MORE THAN THE ABOVE

HISTOGRAM OF VARIABLE 9

MIN # -0.000000 MAX # 3.000000



BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
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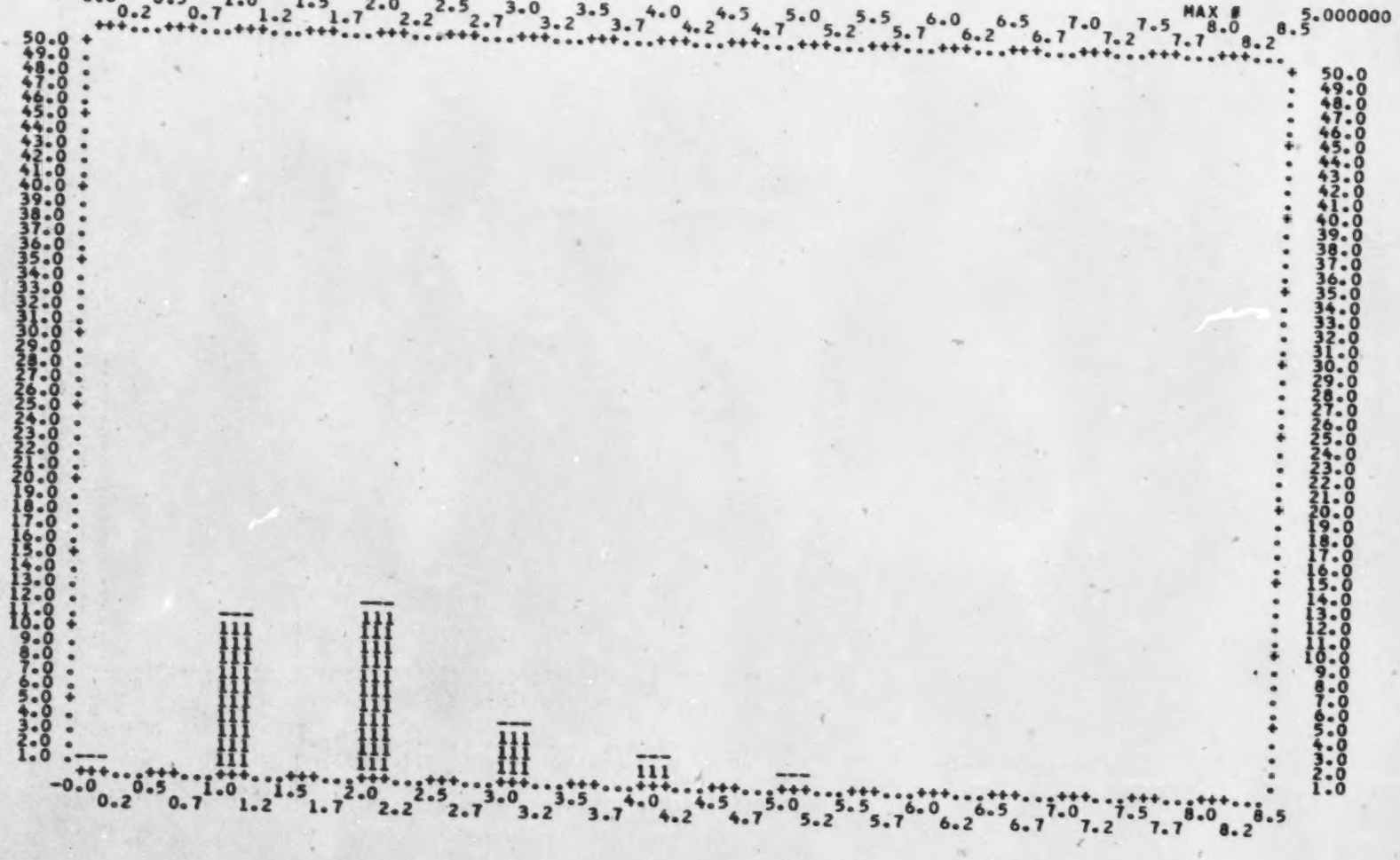
QUESTION 10: TOTAL NUMBER OF JOURNALS,MAGAZINES, AND NEWSPAPERS READ
1=1-2, 2=3-4, 3=5-6, 4=6-8, 5=MORE THAN THE ABOVE

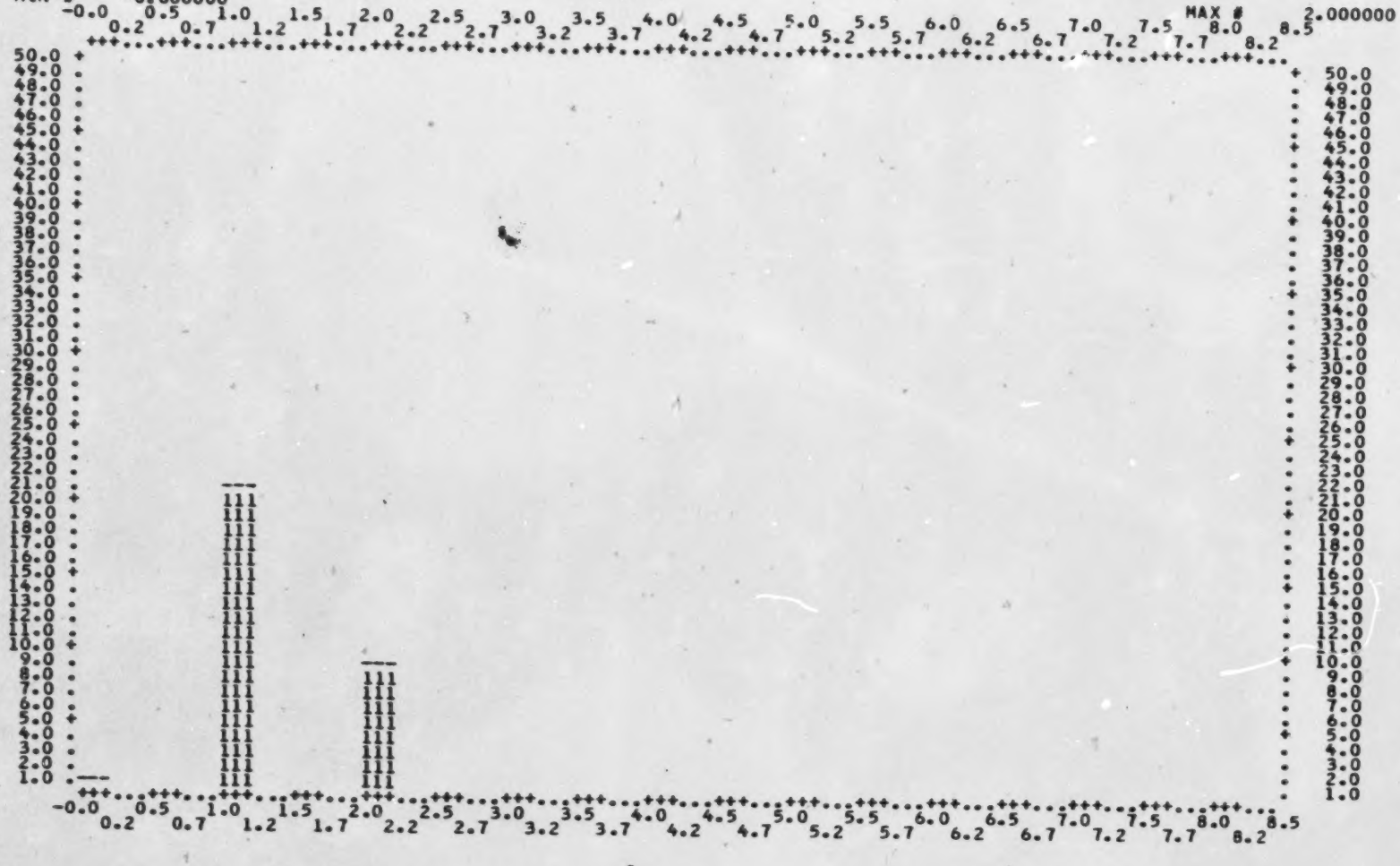
HISTOGRAM OF VARIABLE 10
MIN # -0.000000 MAX # 5.000000



BMD05D GENERAL PLOT - INCLUDING HISTOGRAM - REVISED JANUARY 30, 1970
HEALTH SCIENCES COMPUTING FACILITY, UCLA

QUESTION 11: NUMBER OF SOCIETIES TO WHICH YOU HOLD CURRENT MEMBERSHIP
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE

HISTOGRAM OF VARIABLE 11
MIN # -0.000000 MAX # 2.000000



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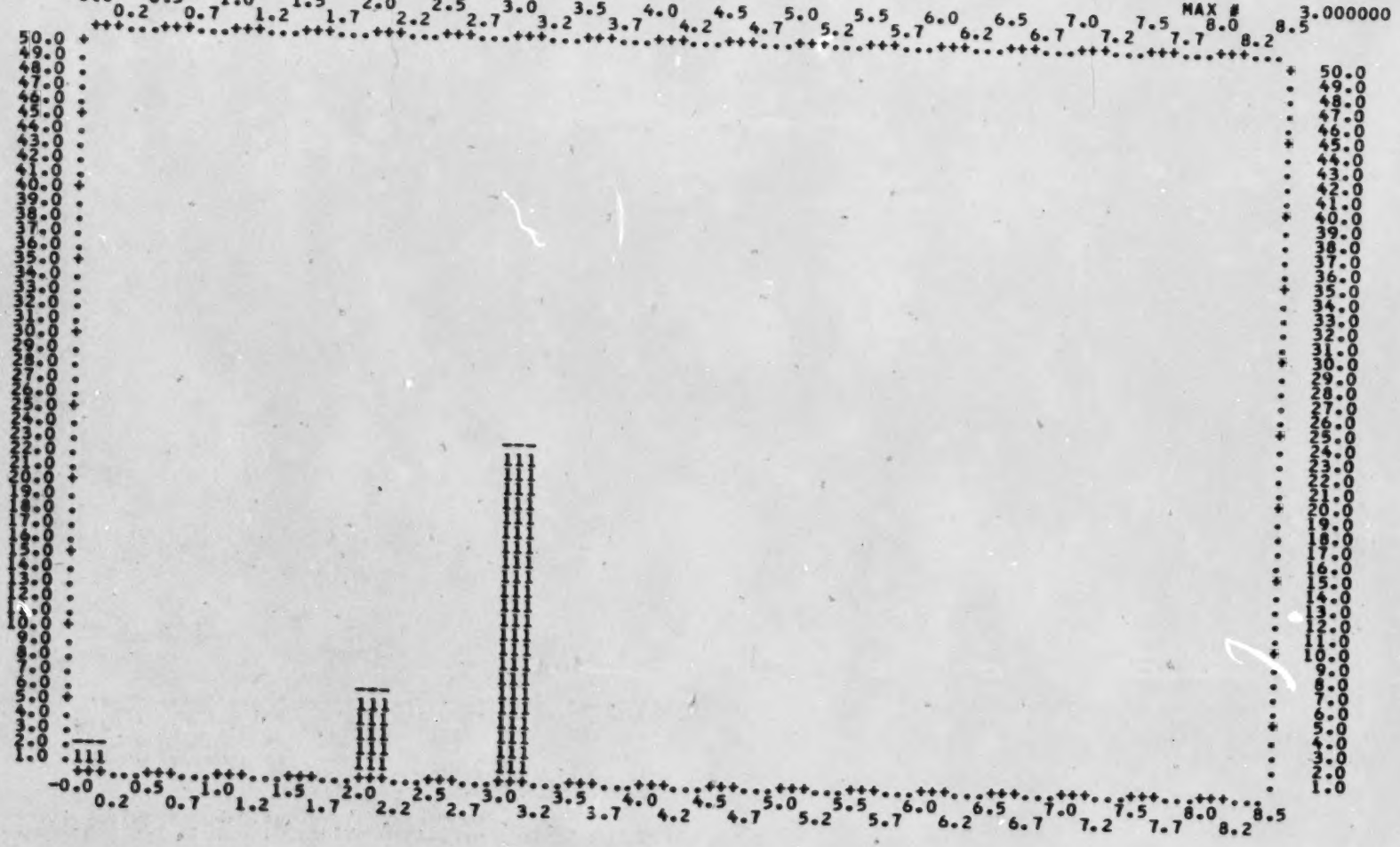
QUESTION 12: ASPIRED LEVEL IN THE SOCIAL STRATA 10 YEARS FROM NOW
1=LOWER-MIDDLE, 2=MIDDLE, 3=UPPER-MIDDLE, 4=LOWER-UPPER, 5=UPPER

HISTOGRAM OF VARIABLE 12
MIN # -0.000000 MAX # 3.000000



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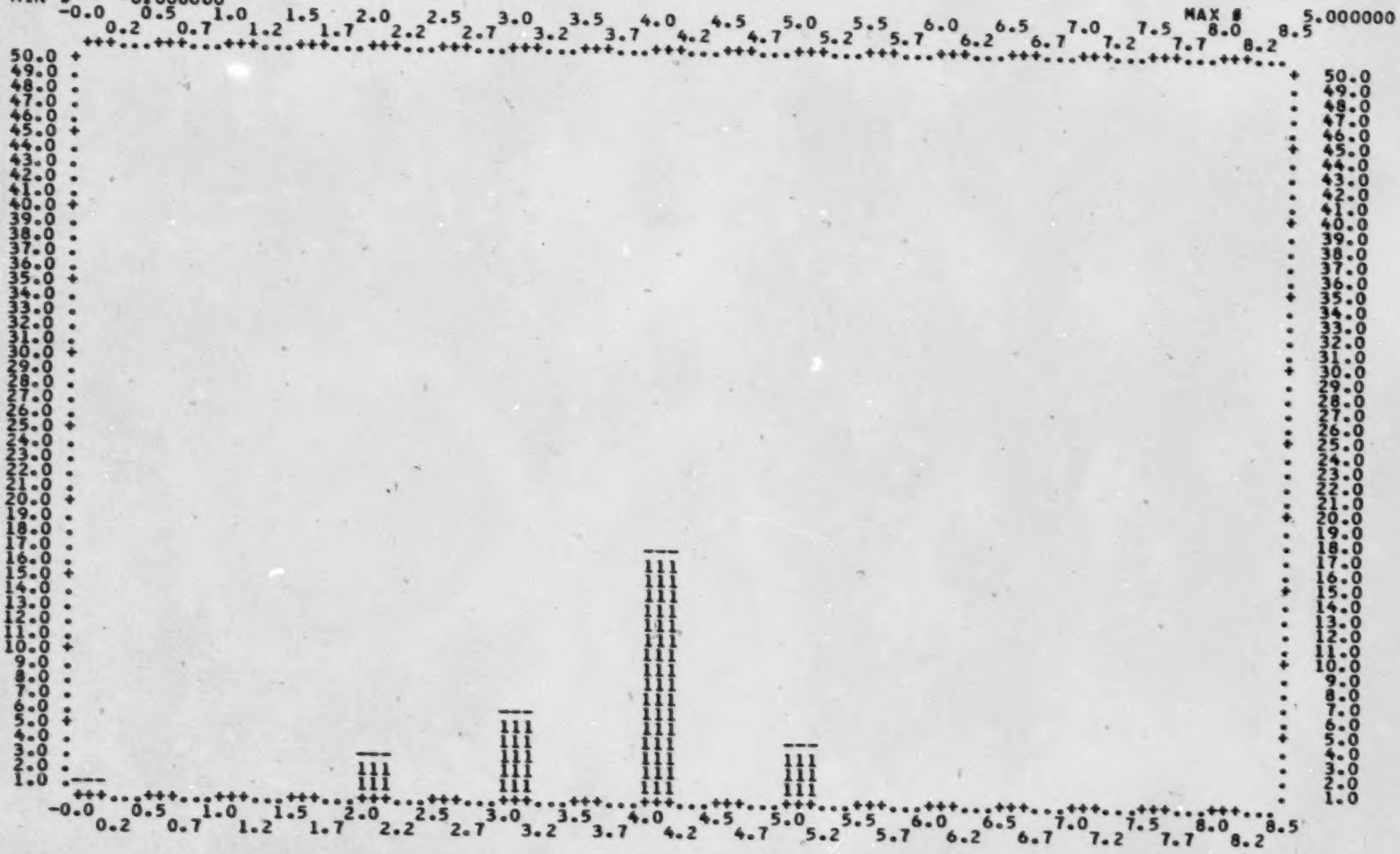
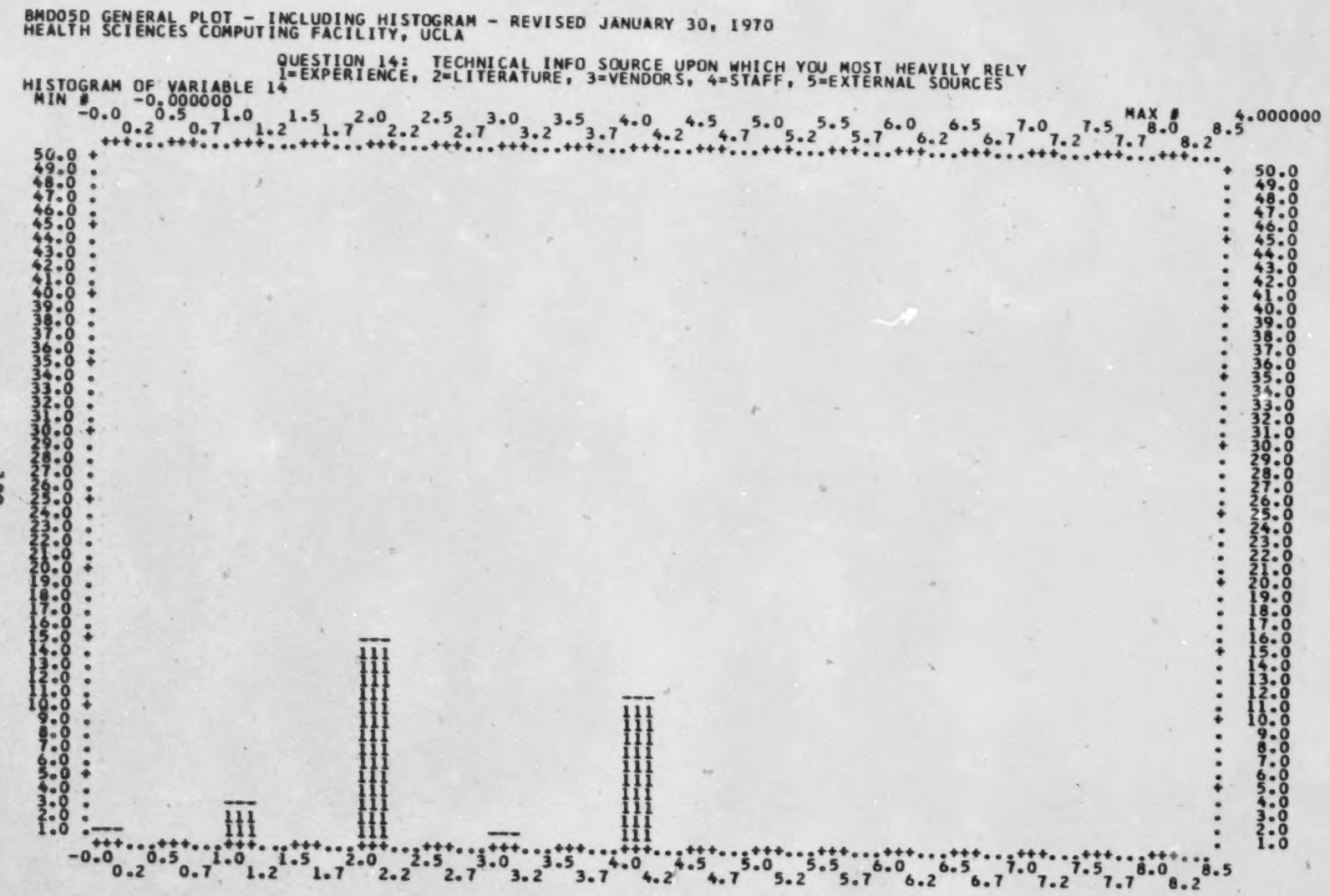
1=WAIT, 2=CONSULTANT, 3=PROTOTYPE, 4=LOCAL PROJECT, 5=MAJOR PROJECT

HISTOGRAM OF VARIABLE 13
MIN # -0.000000 MAX # 5.000000

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HISTOGRAM OF VARIABLE 14
MIN # -0.000000
MAX # 4.000000

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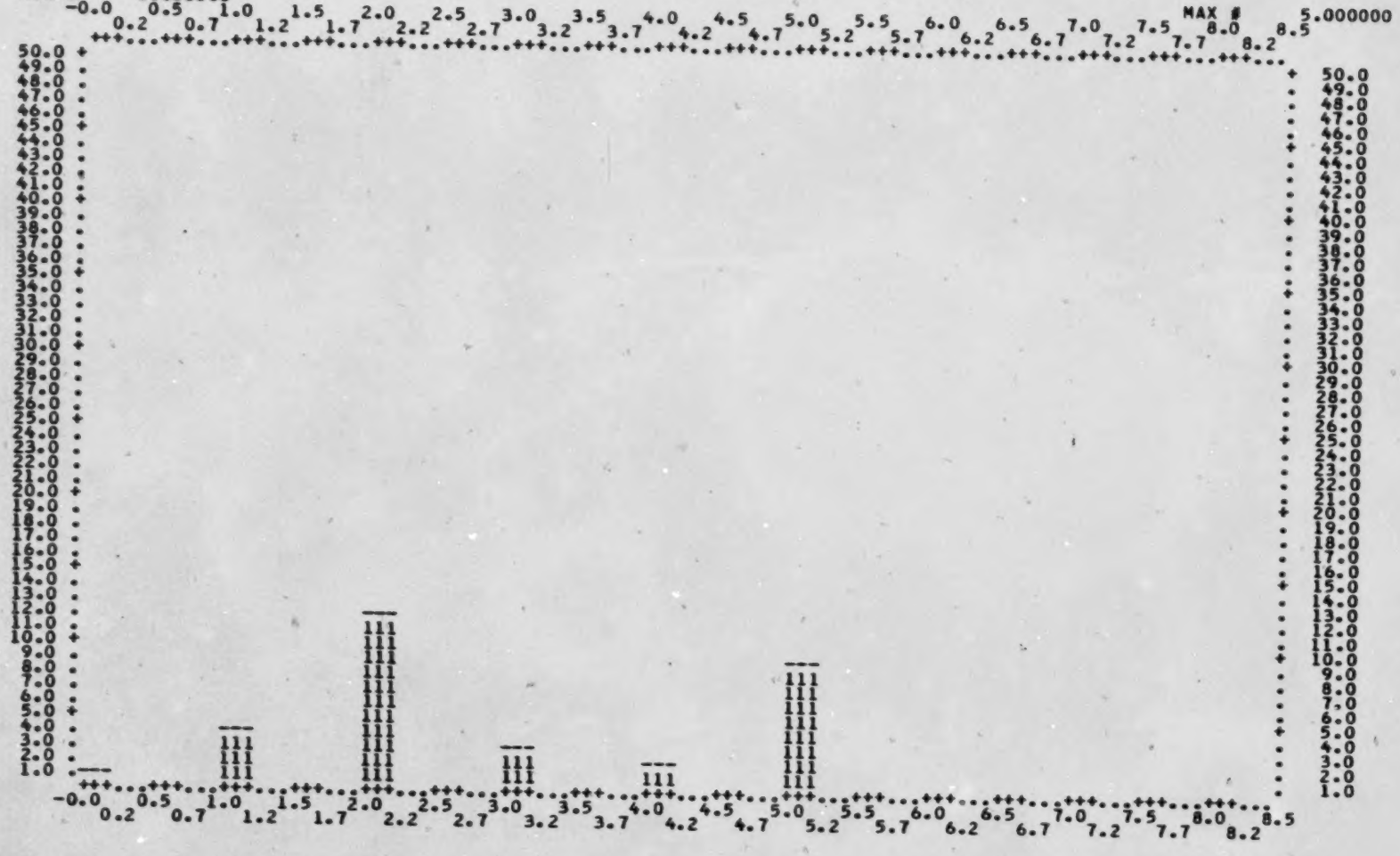
1=SPECIALIZED FIELD, 2=COLLEAGUES, 3=COMMUNITY, 4=OTHER, 5=NONE

HISTOGRAM OF VARIABLE 15
MIN # -0.000000 MAX # 5.000000



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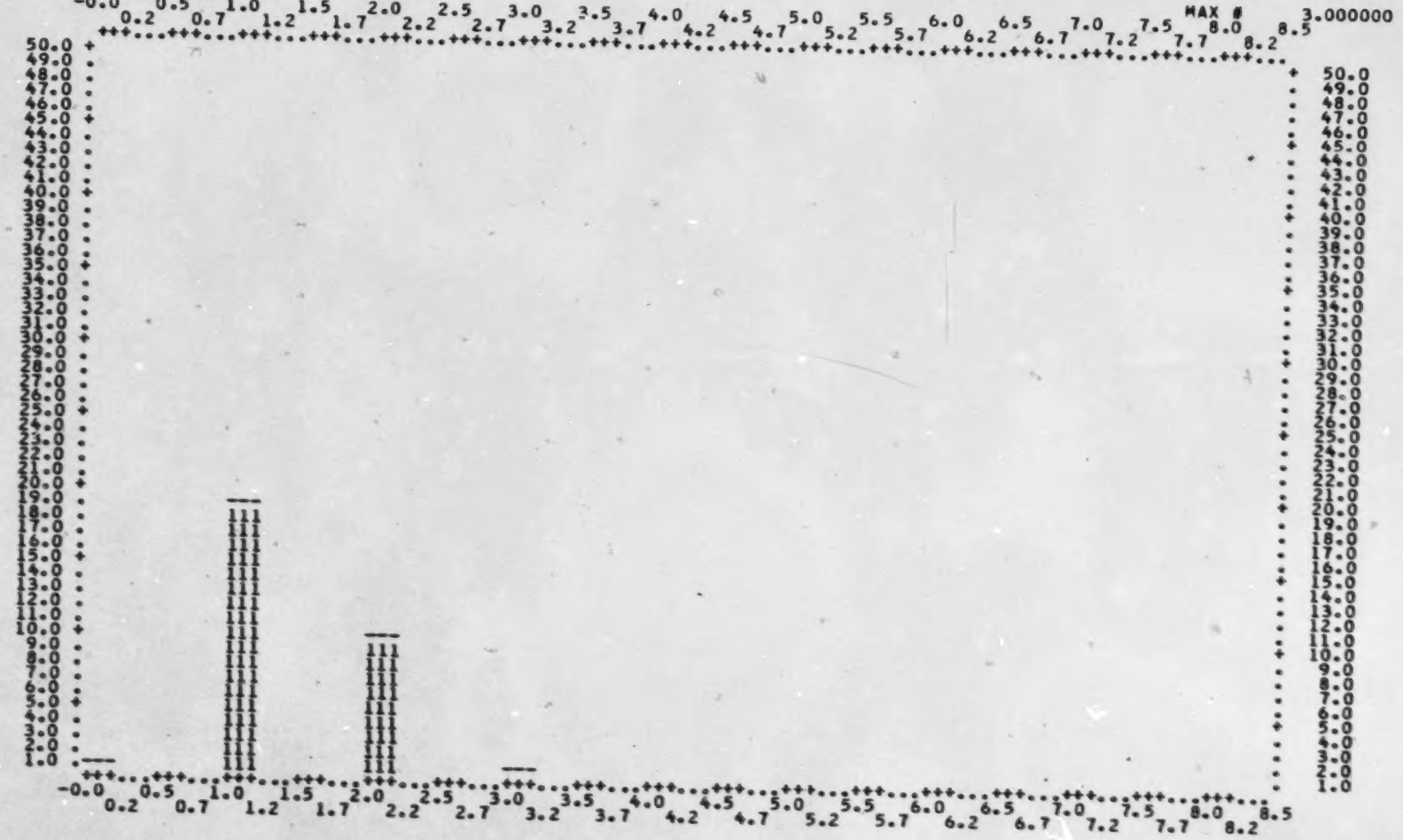
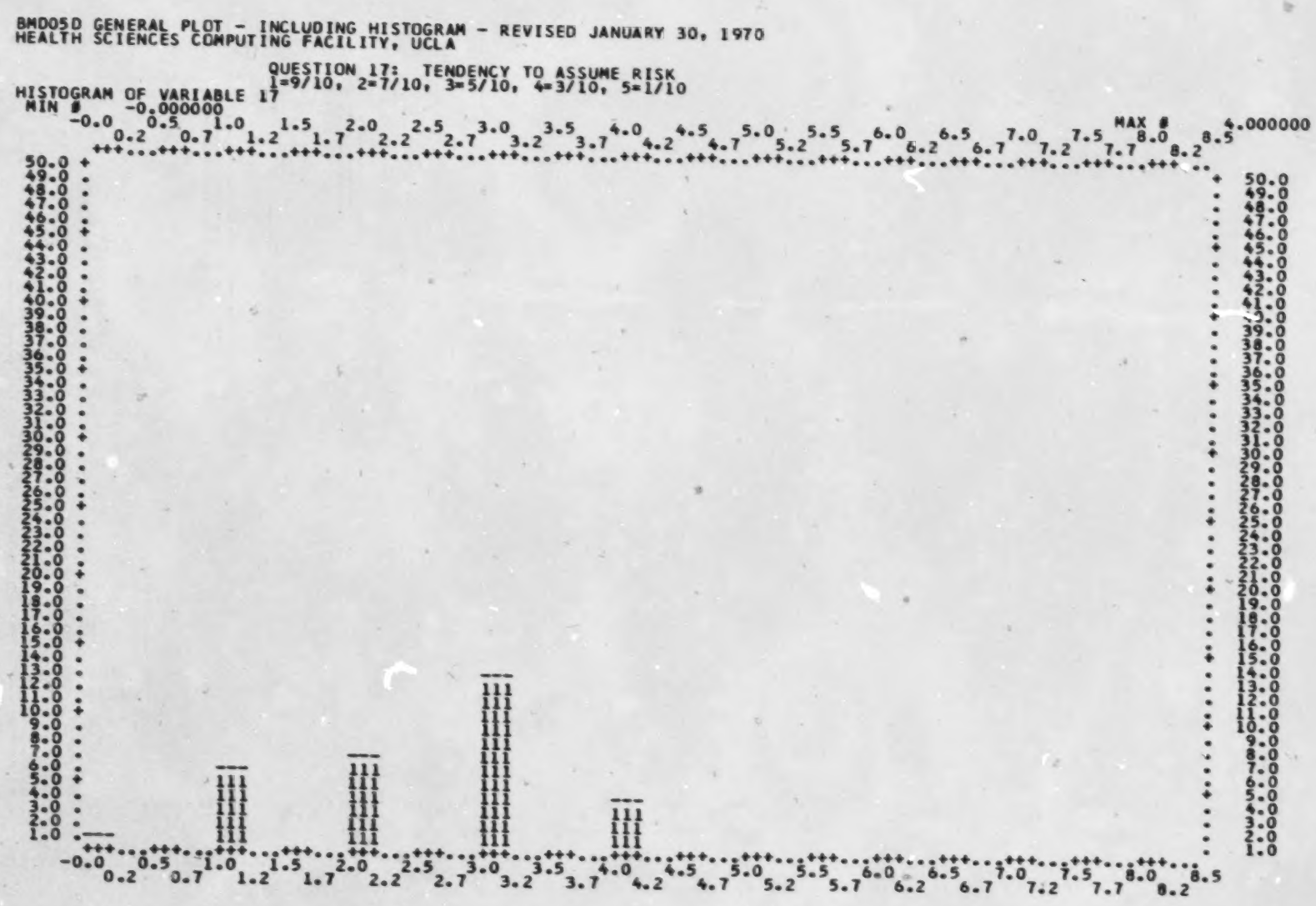
1=0, 2=1-2, 3=3-4, 4=5-6, 5=MORE THAN ABOVE

HISTOGRAM OF VARIABLE 16
MIN # -0.000000 MAX # 3.000000

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1=9/10, 2=7/10, 3=5/10, 4=3/10, 5=1/10
HISTOGRAM OF VARIABLE 17
MIN # -0.000000
MAX # 4.000000

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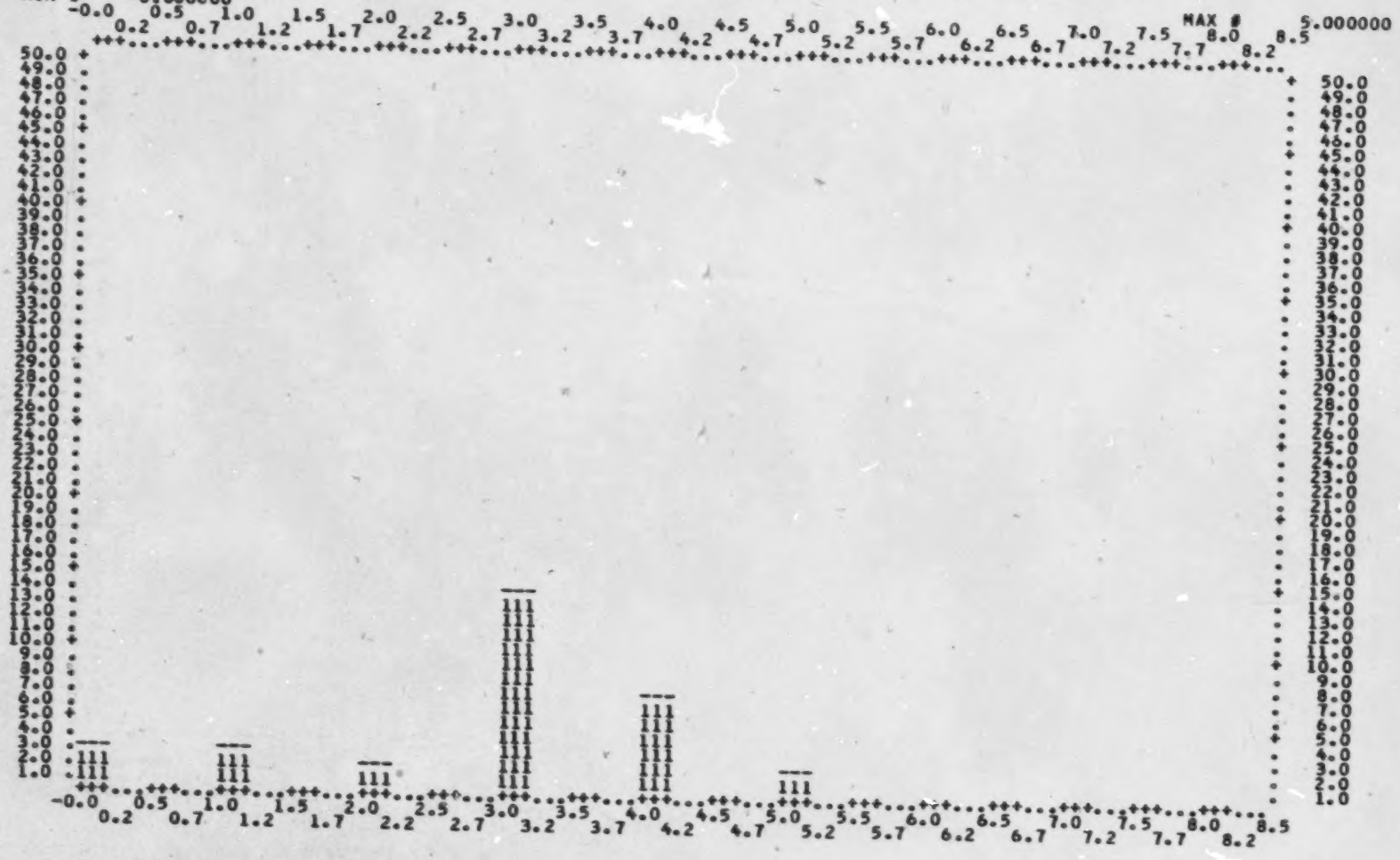
1=PROVEN, 2=SKEPTICAL, 3=DELIBERATE, 4=DISCRETE USE, 5=EAGER TO ADOPT

HISTOGRAM OF VARIABLE 18
MIN # -0.000000 MAX # 5.000000



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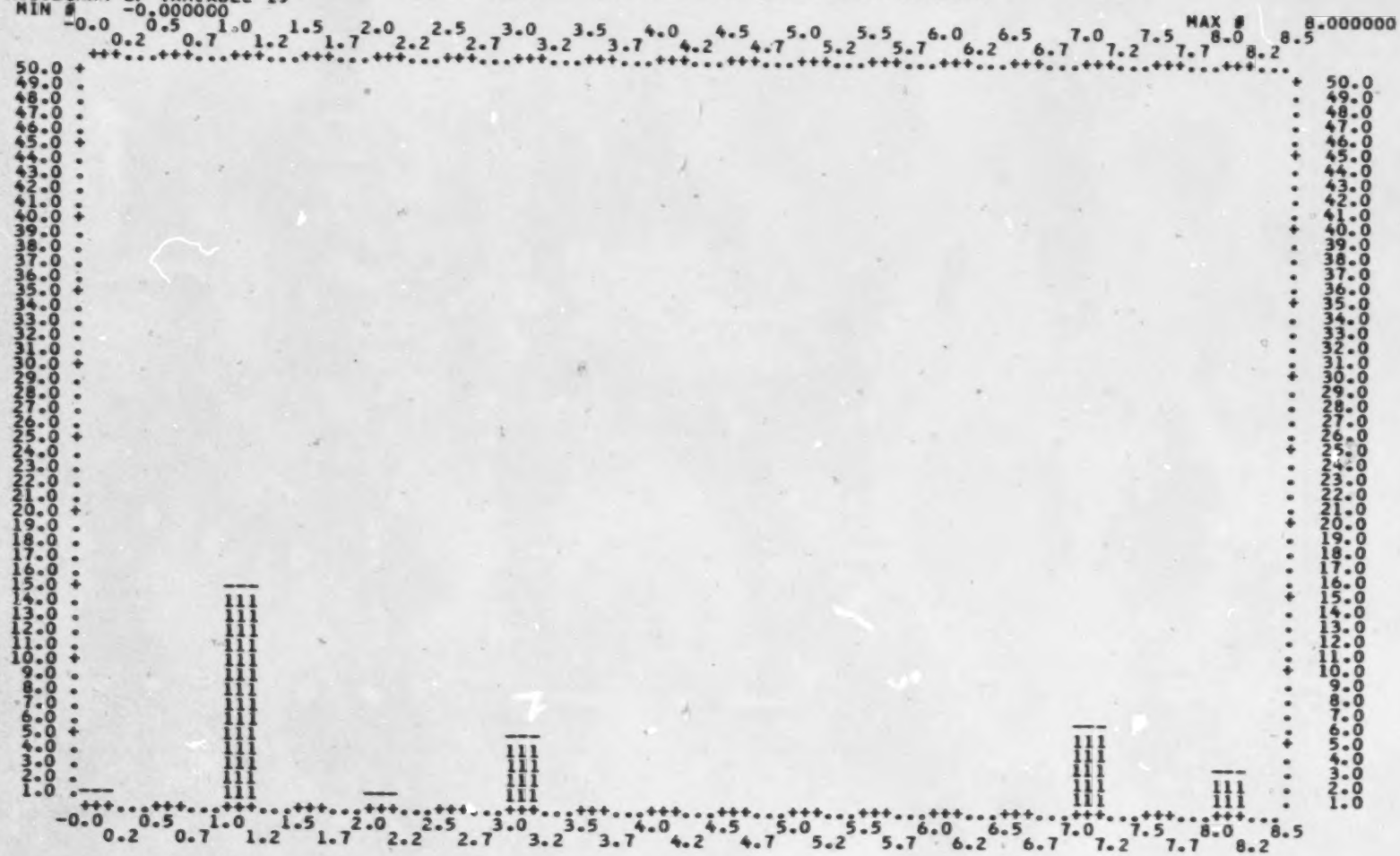
1=PWO, 2=OICC, 3=ROICC, 4=COMB, 5=DUIN, 6=EFD, 7=CB, 8=OTHER

HISTOGRAM OF VARIABLE 19
MIN # -0.000000 MAX # 8.000000



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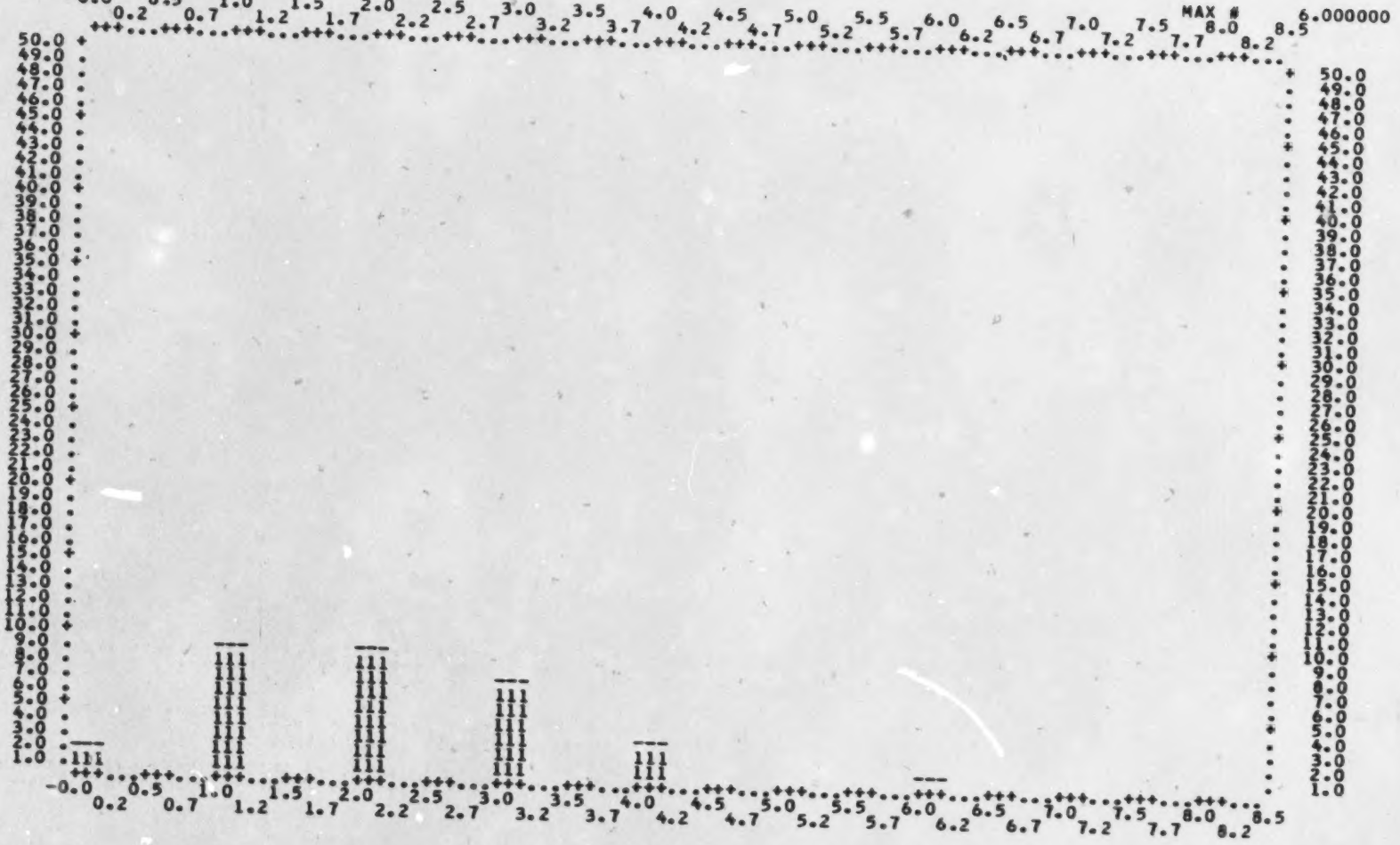
QUESTION 20: PRESENT RANK
0=CWO, 1=ENS, 2=LTJG, 3=LT, 4=LCDR, 5=CDR, 6=CAPT, 7=RADM

HISTOGRAM OF VARIABLE 20
MIN # -0.000000 MAX # 6.000000



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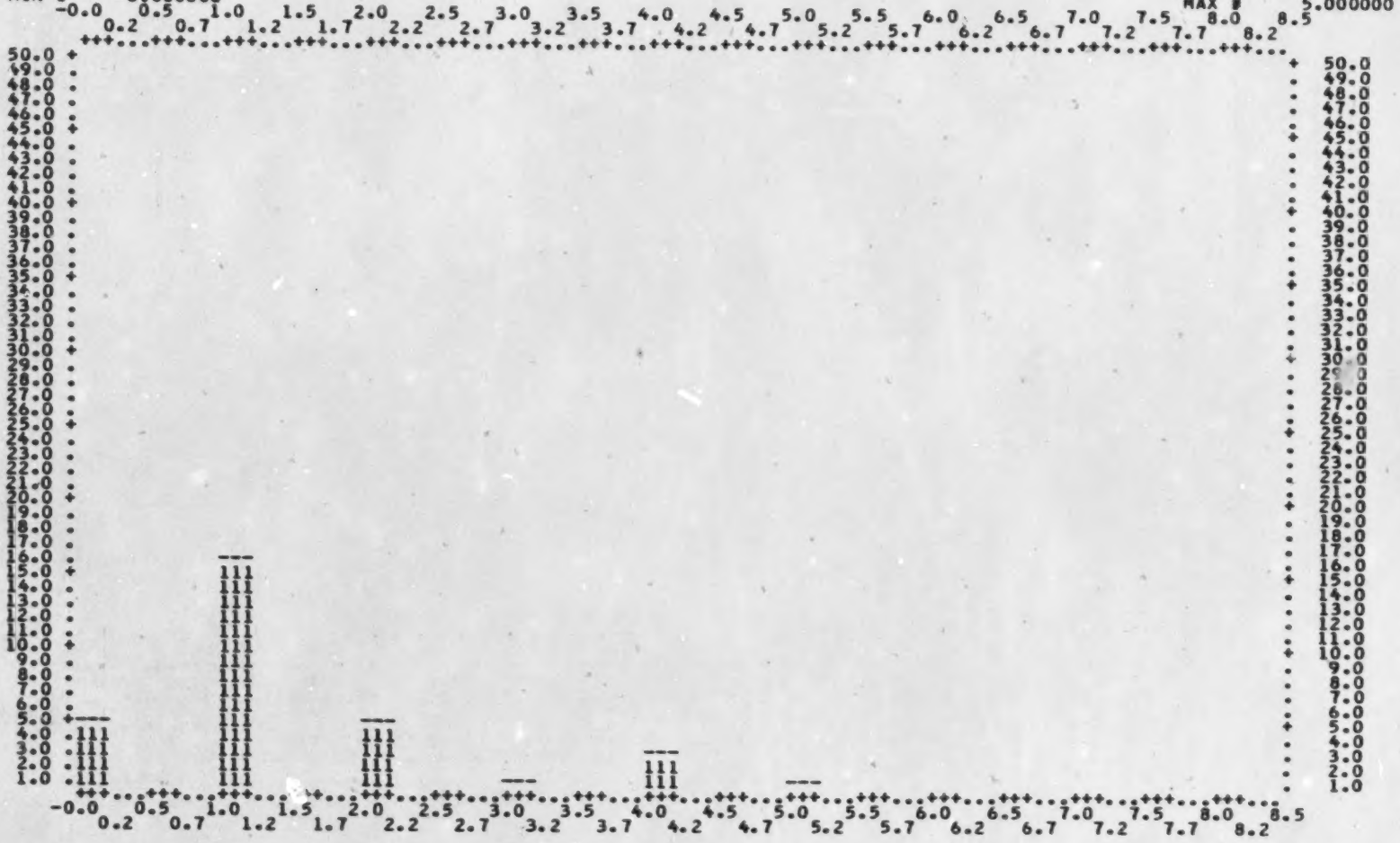
QUESTION 21: NUMBER OF YEARS YOU HAVE HELD YOUR PRESENT RANK
0=0, 1=1, 2=2, 3=3, 4=4, 5=5, 6=6, 7=7, 8=GREATER THAN OR EQUAL TO 8

HISTOGRAM OF VARIABLE 21
MIN # -0.000000 MAX # 5.000000



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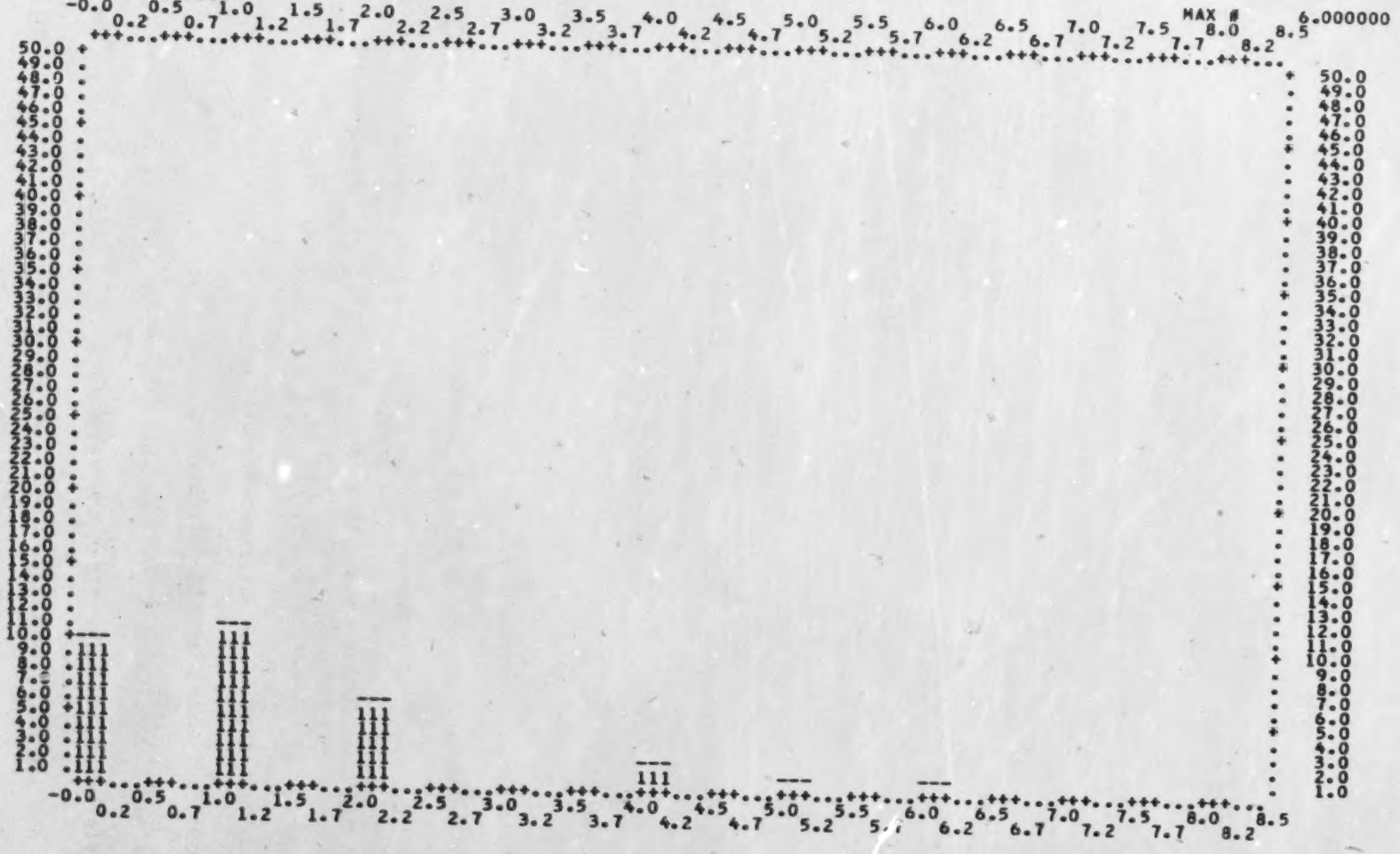
QUESTION 22: NUMBER OF YEARS YOU HELD YOUR PREVIOUS RANK
0=0, 1=1, 2=2, 3=3, 4=4, 5=5, 6=6, 7=7, 8=GREATER THAN OR EQUAL TO 8

HISTOGRAM OF VARIABLE 22
MIN # -0.000000 MAX # 6.000000



Appendix Ten

The Chi-Square Test of Independence

The x^2 test was used to determine the significance of differences between the two independent groups; i.e., the linkers and the stabilizers. The null hypothesis under test was that the two groups differ with respect to their response to the individual questions on the RPPC. In other words, the two groups are independent with respect to response.

To test this hypothesis, the number of responses to each part of each question were counted for each group. The proportion of responses from the linkers were then compared with the proportion of responses from the stabilizers.

The null hypothesis was tested by

$$x^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(Oij - Eij)^2}{Eij}$$

Where Oij = observed number of cases categorized in the i^{th} row of the j^{th} column.

Eij = number of cases expected under H_o to be categorized in the i^{th} row of the j^{th} column.

The values of x^2 yielded by the above formula are distributed approximately as chi-square with df = (r-1)(k-1), where r = the number of rows and k = the number of columns in the contingency table.

The expected frequency for each cell (Eij) was found by multiplying the two marginal totals common to a particular cell, and then divide this product by the total number of cases, 71.

Note that if the observed frequencies are in close agreement with the expected frequencies, the differences (Oij - Eij) will be small, and consequently the value of x^2 will be small. However, if some or many of the differences are large, then the value of x^2 will also be large. The larger is x^2, the more likely it is that the two groups differ with respect to the

classifications. It should also be noted that the test will tell only whether or not the two groups are independent. It will not tell the degree of association or the direction of dependency.

The contingency tables used in this analysis are included as part of this Appendix.

Question One

	L*	S**	T	χ^2
0	0 (.58)	1 (.42)	1	1.38
1	0 (.58)	1 (.42)	1	1.38
2	0 (3.45)	6 (2.55)	6	8.12
3	3 (11.50)	17 (8.50)	20	14.78
4	27 (17.25)	3 (12.75)	30	12.95
5	11 (7.48)	2 (5.52)	13	3.90
	41	30	71	42.51

* L = Linkers ** S = Stabilizers

Question Two

	L	S	T	χ^2
1	7 (12.65)	15 (9.35)	22	5.94
2	4 (6.90)	8 (5.10)	12	2.87
3	0 (0)	0 (0)	0	0
4	0 (1.15)	2 (.85)	2	2.71
5	30 (20.13)	5 (14.87)	35	11.39
	41	30	71	22.91

Question Three

	L	S	T	χ^2
1	0 (4.03)	7 (2.97)	7	9.51
2	0 (6.33)	11 (4.67)	11	14.91
3	15 (15.52)	12 (11.48)	27	.04
4	17 (9.77)	0 (7.23)	17	12.58
5	9 (5.18)	0 (3.82)	9	6.64
	41	30	71	43.68

Question Four

	L	S	T	χ^2
0	0 (1.15)	2 (.85)	2	2.71
1	1 (8.63)	14 (6.37)	15	15.86
2	0 (8.05)	14 (5.95)	14	18.95
3	5 (2.87)	0 (2.13)	5	3.71
4	3 (1.73)	0 (1.27)	3	2.20
5	32 (18.40)	0 (13.60)	32	23.65
	41	30	71	67.08

Question Five

	L	S	T	x^2
1	1 (12.65)	21 (9.35)	22	25.20
2	4 (6.90)	8 (5.10)	12	2.87
3	12 (7.48)	1 (5.52)	13	6.43
4	10 (5.75)	0 (4.25)	10	7.39
5	14 (8.05)	0 (5.95)	14	10.34
	41	30	71	52.23

Question Six

	L	S	T	x^2
1	0 (1.15)	2 (.85)	2	2.71
2	1 (6.33)	10 (4.67)	11	10.56
3	2 (9.20)	14 (6.80)	16	13.26
4	15 (10.35)	3 (7.65)	18	4.91
5	23 (13.80)	1 (10.20)	24	14.43
	41	30	71	45.87

Question Seven

	L	S	T	x^2
1	0 (7.48)	13 (5.52)	13	17.58
2	2 (8.63)	13 (6.37)	15	12.00
3	4 (4.60)	4 (3.40)	8	.18
4	2 (1.15)	0 (.85)	2	1.48
5	33 (19.00)	0 (14.00)	33	24.30
	41	30	71	

Question Eight

	L	S	T	x^2
1	0 (.58)	1 (.42)	1	1.38
2	5 (8.05)	9 (5.95)	14	2.71
3	9 (12.65)	13 (9.35)	22	2.48
4	16 (13.22)	7 (9.78)	23	1.38
5	11 (6.33)	0 (4.67)	11	8.12
	41	30	71	16.07

Question Nine

	L	S	T	x^2
0	0 (.58)	1 (.42)	1	1.38
1	1 (12.10)	20 (8.90)	21	24.00
2	6 (7.48)	7 (5.52)	13	.69
3	11 (7.48)	2 (5.52)	13	3.90
4	8 (4.60)	0 (3.40)	8	5.92
5	15 (8.63)	0 (6.37)	15	11.07
	41	30	71	46.96

Question Ten

	L	S	T	x^2
1	0 (6.33)	11 (4.67)	11	14.91
2	0 (6.90)	12 (5.10)	12	16.25
3	4 (4.60)	4 (3.40)	8	.18
4	9 (6.33)	2 (4.67)	11	2.66
5	28 (16.70)	1 (12.30)	29	17.65
	41	30	71	51.65

Question Eleven

	L	S	T	x^2
1	2 (13.20)	21 (9.80)	23	22.30
2	11 (11.50)	9 (8.50)	20	.05
3	19 (10.90)	0 (8.10)	19	14.11
4	7 (4.03)	0 (2.97)	7	5.16
5	2 (1.15)	0 (.85)	2	1.48
	41	30	71	43.10

Question Twelve

	L	S	T	x^2
0	0 (.58)	1 (.42)	1	1.38
1	0 (0)	0 (0)	0	0
2	0 (3.46)	6 (2.54)	6	8.17
3	7 (17.30)	23 (12.70)	30	14.48
4	13 (7.48)	0 (5.52)	13	9.59
5	21 (12.10)	0 (8.90)	21	15.44
	41	30	71	49.06

Question Thirteen

	L	S	T	x^2
1	0 (0)	0 (0)	0	0
2	0 (1.73)	3 (1.27)	3	4.09
3	0 (3.46)	6 (2.54)	6	8.18
4	20 (21.30)	17 (15.70)	37	.29
5	21 (14.40)	4 (10.60)	25	7.12
	42	31	73	19.68

Question Fourteen

	L	S	T	x^2
1	3 (3.46)	3 (2.54)	6	.14
2	24 (22.40)	15 (16.60)	39	.03
3	3 (2.30)	1 (1.70)	4	.50
4	9 (11.50)	11 (8.50)	20	1.28
5	2 (1.15)	0 (.85)	2	1.48
	41	30	71	3.43

Question Fifteen

	L	S	T	x^2
1	4 (4.60)	4 (3.40)	8	.18
2	23 (20.13)	12 (14.87)	35	.96
3	3 (3.46)	3 (2.54)	6	.14
4	3 (2.87)	2 (2.13)	5	.01
5	8 (9.77)	9 (7.23)	17	.75
	41	30	71	2.04

Question Sixteen

	L	S	T	x^2
1	0 (10.90)	19 (8.10)	19	25.60
2	3 (7.48)	10 (5.52)	13	6.31
3	7 (4.60)	1 (3.40)	8	2.94
4	9 (5.18)	0 (3.82)	9	6.64
5	22 (12.65)	0 (9.35)	22	16.26
	41	30	71	57.75

Question Seventeen

	L	S	T	x^2
1	1 (4.03)	6 (2.97)	7	5.36
2	3 (5.75)	7 (4.25)	10	3.09
3	21 (19.50)	13 (14.50)	34	2.70
4	11 (8.63)	4 (6.37)	15	15.32
5	5 (2.87)	0 (2.13)	5	3.71
	41	30	71	30.18

Question Eighteen

	L	S	T	x^2
0	0 (1.15)	2 (.85)	2	2.71
1	0 (1.73)	3 (1.27)	3	4.08
2	0 (1.15)	2 (.85)	2	2.70
3	4 (10.35)	14 (7.65)	18	9.17
4	22 (16.70)	7 (12.30)	29	3.96
5	15 (9.77)	2 (7.23)	17	6.58
	41	30	71	29.20

Appendix Eleven

The Discriminant Functions

The discriminant function for each group is in the form

$$D = \alpha_G + \sum_{Q=1}^{K=18} B_Q^G \, X_Q$$

where α_G = a constant value for each group G

B_Q^G = a constant value for each group G and each question Q.

X_Q = individual respondent's score for each question.

The three groups were defined as follows:

Group 1: Stabilizers and Potential Stabilizers

Group 2: Linkers and Potential Linkers

Group 3: Respondents not included in Group 1 or Group 2

Values of B

Question	Group 1	Group 2	Group 3
1	4.86229	6.68759	5.72912
2	2.95487	4.59303	3.75959
3	5.63717	7.41949	6.47843
4	1.31925	2.93600	2.09112
5	2.52020	3.93715	3.07595
6	3.99755	5.95898	4.93994
7	2.45309	4.08781	3.17665
8	5.04749	7.01263	5.99408
9	3.73487	5.83824	4.64551
10	2.86151	4.91444	3.76087
11	4.55172	6.97519	5.60306
12	5.18991	7.34352	6.10150
13	6.17910	7.58129	7.00449
14	2.80927	3.01873	2.89091
15	1.49895	1.59947	1.49141
16	1.20997	2.92030	1.92206
17	3.86191	5.51924	4.48920
18	7.45773	9.67912	8.73197
	$\alpha_1 = -90.40521$	$\alpha_2 = -181.99390$	$\alpha_3 = -128.36829$

Table 1 - Classification by Group

	Group 1	Group 2	Group 3	
Group 1	158	0	0	158
Group 2	0	173	0	173
Group 3	77	35	685	797
	235	208	685	1128

Table 2 - Classification by Rank

	WO	ENS	LTJG	LT	LCDR	CDR	CAPT & ADM
WO	21	1	2	1	0	2	3
ENS	12	81	20	11	4	4	10
LTJG	25	60	57	25	16	21	19
LT	30	62	34	42	33	34	18
LCDR	31	16	21	21	52	39	31
CDR	14	9	21	17	19	56	51
CAPT & ADM	1	8	5	3	7	16	42

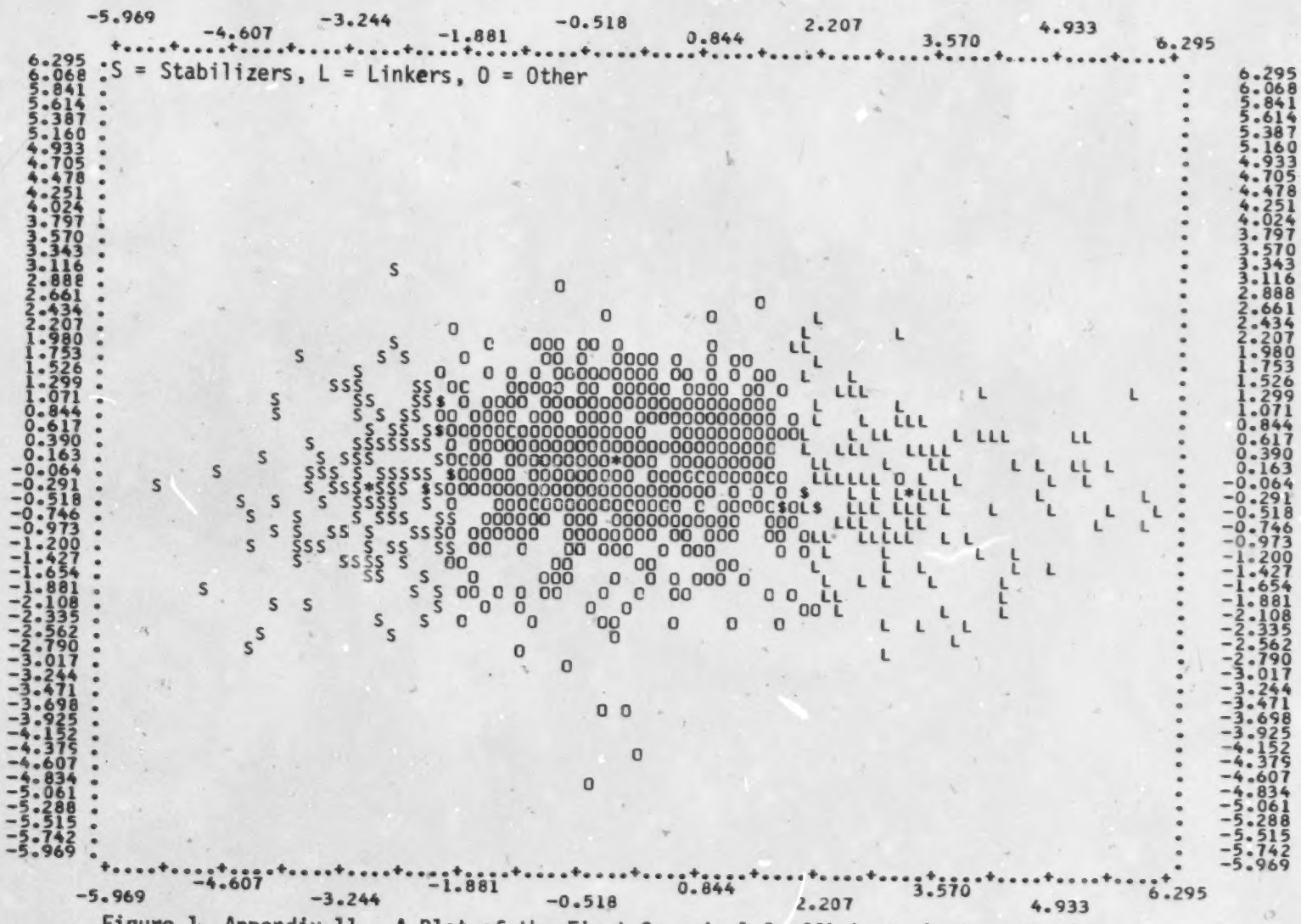


Figure 1, Appendix II. A Plot of the First Canonical Coefficients Against the Second

The plot graphically illustrates the ability of the 18 questions to separate the Linkers from the Stabilizers.

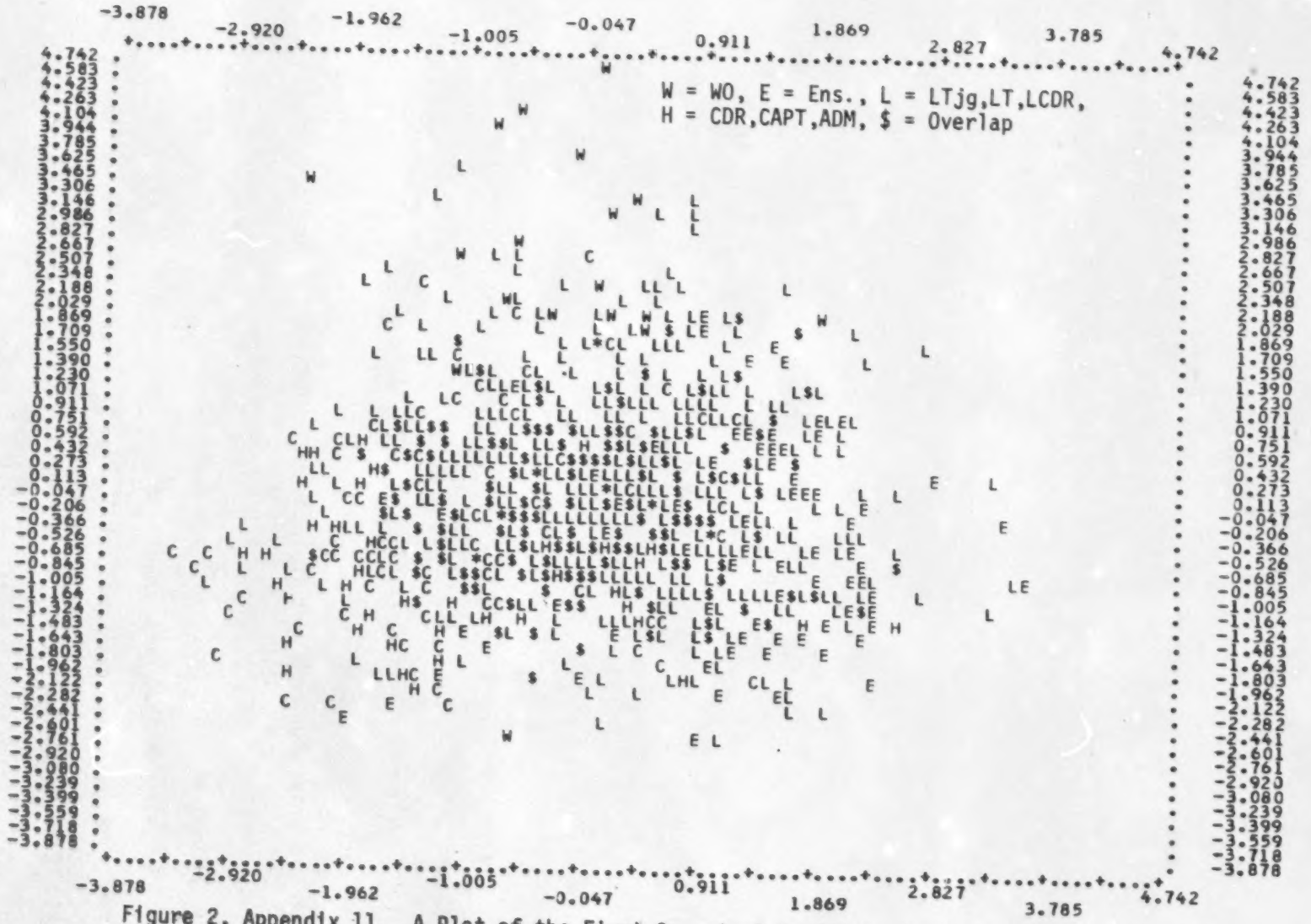


Figure 2, Appendix 11. A Plot of the First Canonical Coefficients Against the Second

The plot graphically illustrates that the 18 questions were not able to discriminate by rank.

Appendix Twelve

The Komogorov-Smirnov Two-Sample Test

The Kolmogorov-Smirnov two-sample test was used to test whether there is agreement between the two sets of scores on the RPCC and the LVC.

If the two samples have in fact been drawn from the same population distribution, then the cumulative distributions of both samples may be expected to be fairly close to each other, inasmuch as they both should show only random deviations from the population distribution. If the two sample cululative distributions are "too far apart" at any point, this suggests that the samples come from different populations. Thus a large enough deviation between the two sample cumulative distributions is evidence for rejecting H_0 .

The null hypothesis used in this test was as follows H_0 : the two sets of scores have come from the same distribution. Since two small (less than 40) independent sets of scores of equal size were being compared, the Kolmogorov-Smirnov two-sample test was applied to the data.

Table 1 of this Appendix gives the raw scores and percentages for the RPPC and the LVC. The scores include 9 stabilizer and 18 linker scores for a total $N = 27$. For analysis by the Kolmogorov-Smirnov test, these data were cast into two cumulative frequency distributions, shown in Table 2. The same intervals were used for both distributions. For each interval, then, one step function is subtracted from the other. The test focuses on the largest of these observed deviations.

$Sn_1(x)$ = the observed cumulative step function for the scores on the RPPC. $Sn_2(x)$ = the observed cumulative step function for the scores on the LVC. The Kolmogorov-Smirnov test focuses on

$$D = \text{maximum}|Sn_1(x) - Sn_2(x)|$$

The sampling distribution of D is known and the probabilities associated

with the occurence of values as large as an observed D under the null hypothesis have been tabled.

Observe from Table 2 that the largest discrepancy between the two was 8/27 . $K_D = 8$, the numerator of this largest difference. Reference to the appropriate table of Critical Values of K_D reveals that when $N = 27$, a value of $K_D = 10$ is significant at the $\alpha = .05$ level for a two-tailed test. Since $K_D < 10$ for the test, the null hypothesis is accepted. The two sets of scores come from the same distribution.

Table 1

	RPPC	%	LVC	%
Stabilizers	31	38.8	25	22.7
	34	42.5	28	25.4
	35	43.7	28	25.4
	35	43.7	28	25.4
	36	45.0	33	30.0
	36	45.0	38	34.6
	36	45.0	39	35.5
	36	45.0	40	36.4
	36	45.0	49	44.5
Linkers	62	77.5	76	69.0
	62	77.5	76	69.0
	62	77.5	77	70.0
	63	78.7	90	82.0
	63	78.7	93	84.5
	63	78.7	94	85.5
	64	80.0	96	87.3
	64	80.0	96	87.3
	65	81.2	98	89.0
	65	81.2	98	89.0
	65	81.2	101	92.0
	67	83.7	101	92.0
	67	83.7	102	92.8
	68	85.0	105	95.6
	68	85.0	106	96.4
	68	85.0	106	96.4
	70	87.5	108	98.1
	70	87.5	109	99.1

Table 2

	Per Cent of Total Score							
	20-30	31-40	41-50	51-60	61-70	71-80	81-90	91-100
$Sn_1(x)$	0/27	1/27	9/27	9/27	9/27	17/27	27/27	27/27
$Sn_2(x)$	5/27	8/27	9/27	9/27	12/27	12/27	19/27	27/27
$\lvert Sn_1(x) - Sn_2(x) \rvert$	5/27	7/27	0/27	0/27	3/27	5/27	8/27	0/27